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ASPIDIUM SPINULOSUM (SWARTZ) AND ITS VARIETIES.

BY GEO. E. DAVENPORT.

DURING several seasons past I have been making some special examinations of the different forms of *Aspidium spinulosum* as found growing in Middlesex county, Mass., and offer the result not as being decisive in character, but for the purpose of calling attention to the points involved, and inviting further investigations in the same direction.

An opinion prevails with many botanists that the large series of forms in this protean species so run into each other, and are oftentimes so confusing and difficult to place, that it would be better to ignore all of the so-called varieties and only recognize all forms under the one specific name. How far this opinion may or may not be correct, and founded on scientific principles, possibly this note may help to determine.

I certainly am not in favor of recognizing as a variety any form not possessing some well marked and permanent character to distinguish it from the recognized typical form of any species. I have so often expressed myself on this point that I do not feel under any apprehension of appearing inconsistent in endeavoring to show that the so-called var. *intermedium* is a good variety at least, if indeed it be not a good species.

The precise distinctions between *Aspidium spinulosum* Swz., and its var. *intermedium* have not as yet been clearly enough pointed out, so that the greatest confusion has prevailed in the effort to verify the presence here of true *spinulosum*, and to discover the differences between it and the variety; the usual assumption having been that nearly if not all of our American plants belonged to the latter form.

My own observations tend to convince me that Swartz's plant is by no means uncommon. Be that as it may, plants are found here abundantly enough that exactly conform to Swartz's description as given by him in his "Synopsis Filicum."

What then is *Aspidium spinulosum* Swz.? Swartz says of it, "Frondibus bipinnatis, pinnis pinnatifidis pinnatisque, laciniis oblongis acutis serrato-spinulosis, fronde ovato-triangularis; rachis glabra, stipite paleaceo." "Addenda et emendata," p. 419 to Synopsis Filicum, 1806. This describes in part nearly all of our American forms. Let us analyze the description and see:

1. *Fronds twice-pinnate.* This is true in many cases of *spinulosum*, and the varieties *dilatatum* and *intermedium*. In large and highly developed specimens of the two last forms the fronds are often thrice-pinnate, and usually appear to be more divided on account of the pinnules being more deeply cut; but the uncertain application of this character to any one particular form renders it unreliable as a specific character, or only of secondary importance.

2. *Pinnules pinnatifid, segments oblong, acute spinulose-toothed.* Common to all of the forms, and therefore as unreliable as the first character.

3. *Frond triangular-ovate.* This more clearly belongs to the var. *dilatatum* than to any other form, although I have had specimens of intermedium that were broadly triangular in outline, and other things corresponding that form might be regarded as Swartz's plant for all there is in the description to the contrary, specimens being found commonly enough that are triangular-ovate in outline, bipinnate in structure, with smooth rachis and pale-brown scales.

4. *Rachis smooth.* This is the case with *spinulosum* and our *dilatatum*, but in *intermedium* the rachis is usually finely glandular. It will be necessary, however, to collect specimens early in order to observe this, as the rachis finally becomes smooth. This makes it difficult, if not impossible, to decide to which form Swartz's description was applied without knowing when, and in what state his plants were collected.

5. *Stipes clothed with pale brown scales.* This is the case, more or less, with all of our forms. The darker scales with blackish centers peculiar to the most highly developed forms are not reliable as a distinctive character.

From this it appears that in point of fact we have no *true spinulosum* as distinguished from other forms unless we choose to make it, and there would be no impropriety in calling it all *spinulosum*, as many are disposed to do, if we did not actually find in nature forms possessing characters sufficiently distinctive to justify recognition.

This being so we can only recognize as typical that form from which, in all probability, the others are most likely to have been derived, and to which, in connection with its special characters, Swartz's description may be best adapted.

Taking, now, the species as a whole, I find that it may be divided into two forms, one being glabrous beneath with perfectly smooth indusia, and the other being more or less finely glandular on the under surface with glandular indusia.

As there are many characters by which we can trace the glandular form to the smooth one, and show clearly enough that if it be not a good species it is at least a variation from that, we may by enlarging the significance of Swartz's "rachis glabra" so as to embrace the smooth indusia, safely assume that the smooth form is Swartz's plant.

But as this distinction is not clearly apparent after the contraction of the indusium in fruit, I have made examinations for the purpose of trying to find some other character by which we could determine specimens with equal certainty at all times; and this I have apparently found in the *position of the sori on the veins.*

Thus I find that in what I here recognize as true *spinulosum* the sori are placed on the *end of the veinlet*, which terminates *within the radius* of the fruit dot, while in the var. *intermedium* the sori are placed on the veinlet *below its apex*, so that it passes through and *beyond the radius* of the fruit dot.

This is a point of distinction between these two forms that has not been noticed heretofore by any one that I am aware of, and although I am not prepared to say that it is invariably the case, it has been so in all of the specimens that I have examined, the only apparent exception having been in the case of two or three imperfectly developed sori.

Let us briefly review and consider the importance of the principal characters of *spinulosum* and the var. *intermedium* as we actually find them in nature.

1. *As to color.* In characteristic specimens the typical form may be readily recognized by the peculiar shade of light-green that distinguishes it from the darker green of the variety. But as we soon find the former growing darker in color and blending with that of *intermedium*, especially as it approaches the so-called var. *dilatatum*, which as we have it in Eastern Massachusetts appears to be only a large, or higher developed state of *spinulosum*, we perceive that the color is not always to be depended upon as a specific character.

2. *As to form.* The terms ovate-lanceolate, oblong-lanceolate and triangular-ovate may be applied to particular fronds of either form, and therefore can only be considered in connection with a series of characters as a whole. In good specimens of what is here recognized as typical *spinulosum*, the fronds will vary from ovate-lanceolate to triangular-ovate. In ordinary forms the two lowest pair of pinnæ are about of an equal length and set obliquely on the rachis; the two or three pairs of pinnæ immediately above are longer, more spreading, though still retaining a somewhat oblique arrangement on the rachis, and give an abruptly dilated appearance to that part of the frond; above, the more or less obliquely-set pinnæ gradually decrease toward the apex, and this comes as near as possible to Swartz's description of "ovato-triangularis."

In characteristic specimens of *intermedium* the frond is usually oblong-lanceolate in outline, with decidedly spreading pinnæ that are not obliquely set on the rachis. But these two forms run together frequently in all sorts of ways, and can only be regarded as of secondary importance.

3. *As to structure.* In ordinary forms of *spinulosum* the fronds are only bipinnate, but this is equally true of the var. *intermedium.*

4. *As to the character of the scales.* This is too unreliable to be considered in any other way than in connection with the whole series of characters. The darker scales with blackish centers are found only on large and vigorous specimens of the var. *intermedium* and, but more rarely in this vicinity, var. *dilatatum*, but both of these forms frequently have pale brown scales like those on *spinulosum.*

5. *As to the character of the indusium.* In *spinulosum* the indu-

sia and under surface of the fronds are perfectly smooth, but in *intermedium* they are more or less glandular.

This character appears to be constant and, therefore, reliable, but it is necessary to collect specimens early in order to observe it, as the glands are fugaceous, quickly disappearing after the indusium begins to contract—a fact which accounts for the difficulty oftentimes experienced in properly placing specimens collected late.

6. *As to the position of the sori on the veins.* If this character proves constant it will be the most important one of all, as it will enable us to place specimens collected at any time with a greater degree of certainty, and, in connection with the character of the indusium, enable us to clear away much of the confusion surrounding the different forms of the species.

I sum up the relative value of the different characters as follows:

1. Color—not constant.
2. Scales—constant in ordinary forms of the species; not constant in the varieties
3. Form—not constant.
4. Structure—not constant.
5. Character of the indusia—constant.
6. Position of the sori on the veins—constant.

It is too much to expect that any species or variety will exactly conform, in every instance, to any prescribed form or character, just as pieces of mechanism cast in dies by the hundred or thousand in unvarying conformity agree with one another; and all we can do is to describe the general characters of a species or variety as we find them in nature.

A species often manifests itself in a great variety of forms, no two plants being exactly alike, and sometimes fronds on the same plant will exhibit surprising variation, so that it is exceedingly difficult to fix the limit and say which of the forms is typical, but as long as these forms can be referred to one common center of variation it does not seem well to recognize any such forms as varieties, and so we endeavor to describe as exactly as possible the character of that center of variation, and judge of all specimens by their relation to that.

When we find plants that cannot be referred to this first center of characters, but evidently proceed from another, if there are no

intermediate forms connecting the second center with the first, then the probabilities are in favor of the second plant being a distinct species; but if the second is directly connected with or related to the first by a graduating series of forms and other characters, then we are justified in regarding the second as a variety of the first, the intermediate forms being rather proofs of the fact than otherwise.

This is exactly the position in which I find *Aspidium spinulosum* and its var. *intermedium.*

As for the so-called var. *dilatatum*, as we have it in Eastern Massachusetts, I have not been able to discover any really good distinctive characters to justify regarding it as anything more than a highly developed state of *spinulosum.* Not only does the form of the fronds often agree with Swartz's description of the species, but frequently, even in very large specimens that appear at first sight more compound, they are only bipinnate in structure. I have so many times traced the ordinary form of the species step by step into our *dilatatum* that I have no faith in it as a variety, but think it should be embraced in the specific description. The smooth under surface and naked indusia clearly place it with the specific form, and in the specimens examined I have found the situation of the sori on the veins exactly the same as in the species.

On the other hand the more northern form, peculiar to the mountainous regions of New Hampshire and Vermont, is so different in appearance, being in every way larger and more compound, that it may be desirable to have some way of designating it, even though the characters are of secondary importance. For this reason it may be as well to retain the variety subject to this limitation.

Var. *Boottii*, I have always been inclined to regard as a distinct species on the supposition of its being a probable hybrid between *A. spinulosum* (*intermedium*) and *A. cristatum*, but if it is to be considered only as a variety, then it comes nearer to *cristatum* than it does to *spinulosum.* So far as my own and the observations of my friends extend, whenever it varies at all it recedes toward *cristatum.* Thus apparently indicating its origin. I have not yet met with a botanist who did not express some such feeling in regard to it.

The upper portion of the fertile frond certainly resembles the

var. *intermedium* in form, in the spinulose character of the pinnæ and the glandular indusia, but on the other hand the lower portion as strongly resembles *A. cristatum*, and it is still more closely connected with the latter species by the character of its sterile fronds. These so often resemble the sterile fronds of *A. cristatum* var. *Clintonianum*, that it is not always possible to separate them if they become mixed. Indeed, the resemblance between the larger forms of *Boottii* and ordinary forms of *Clintonianum* is sometimes so striking that it would be exceedingly difficult to distinguish them if it was not that in *Boottii* the indusiums are always covered with minute glands, while in *Clintonianum* they are perfectly smooth.

For these reasons I cannot subscribe to the opinion that its nearest affinity is with *spinulosum*, but favor removing it altogether from that species, and either placing it with *cristatum* or restoring it to its specific distinction.

But I will not undertake to decide this question here, the only object of the present paper being to give the results of my recent examinations, and to show, first, that we have good typical specimens of *A. spinulosum* in abundance, and second, that the var. *intermedium* possesses sufficiently good distinctive characters to justify our regarding it as a good variety, if not a species.

I submit the following (partial) descriptions of the two forms, intended only to cover the principal points in the present paper:

ASPIDIUM SPINULOSUM Swz. (*A. intermedium* Willd.)

1 to 3 feet high. Stipes clothed with pale or dark brown scales; fronds usually of a light (yellowish) green, sometimes dark, varying from ovate-lanceolate to triangular-ovate, twice or thrice pinnate; pinnæ arranged obliquely on the rachis, the lowest pairs unequally triangular-ovate or sub-deltoid, usually shorter and more oblique than those immediately above, lower pinnules often greatly elongated.

Under surface smooth; indusiums naked; sori terminal on the veins.

ASPIDIUM SPINULOSUM var. *intermedium* Eaton. (*A. spinulosum* Willd.)

1 to 3 feet high. Scales of the stipes pale brown, or brown with darker centers; frond usually dark green, oblong-lanceolate, twice or thrice pinnate; pinnæ spreading, lower often unequally triangular-ovate with elongated lower pinnules.

Under surface finely glandular; indusiums covered with stalked glands; sori medial or sub-terminal on the veins.

Medford, Mass., July, 1878.

NOTE.—In the foregoing paper I have not ventured to disturb the specific arrangement of the plants under consideration, but as the positions therein assumed may, if clearly established, render a re-arrangement necessary, I offer the following sugges-

tion as a basis for a re-arrangement of the different forms of *A. spinulosum* and *cristatum*:

1. ASPIDIUM SPINULOSUM Swz.

   B. var. *dilatatum* Eaton, in Gray's Manual.—Embracing only the extreme northern form.

2. ASPIDIUM AMERICANUM. (*A. spinulosum* Willd., *A. spinulosum*, var. *intermedium* Eaton.)

   1 to 3 feet or more high; scales of the stipe pale or dark brown, often with darker centers, ovate or ovate-acuminate below, paler, narrowly lanceolate, and scattered along the main and secondary rachises above; frond ovate or oblong-lanceolate, twice or thrice pinnate; pinnæ spreading, lanceolate or ovate-lanceolate, acuminate, lower pair sometimes unequally triangular-ovate, with the lower pinnules elongated; pinnules oblong-ovate, acute, lower series longest, more or less incised, or cut clear to the rachis becoming again pinnate; lobes obliquely oblong, spinulosely toothed. Frond dark, often light green, stipe, rachises and veins sometimes purplish, *under surface minutely glandular, sori medial, indusiums glandular.*

3. ASPIDIUM BOOTTII Tuckerman. *Aspidium spinulosum* var. *Boottii* Eaton, in Gray's Manual.

4. ASPIDIUM CRISTATUM Swz.

   B. var. *Clintonianum* Eaton.

   C. var. *Floridanum* Eaton.

I offer the following remarks on the above arrangement:

It is with considerable hesitation that I venture to recommend a new name for a fern so long known as a form of *A. spinulosum* under the name of *intermedium*, as I do not wish to appear to show any disposition to multiply species unnecessarily, or to disturb established and familiar names; but in reëstablishing the present form as a species there appears to be no alternative between doing this and adopting Willdenow's name of *A. intermedium*—a name heretofore improperly applied to our form. But that author's name does not belong here, for his description of *A. intermedium* does not contain a word in regard to the glandular indusiums and under surface, while, on the other hand, his description of *A. spinulosum* does, thus exactly reversing the usual arrangement.

For this reason we cannot write *A. intermedium* Willd., and as Swartz's name of *A. spinulosum* takes precedence and belongs to another form, we are also debarred from writing *A. spinulosum* Willd., thus leaving our plant without a name. Therefore we have no alternative but to provide a new one, and in selecting the present name I have taken into consideration the fact that our American form has always been regarded as peculiar to this continent, a fact which the present name definitely expresses.

The name itself has been used in part only, apparently to describe some form of *A. spinulosum* Sw. (*spinulosum-americanum* Fisch., MS., Index Fil. Moore, p. 104) but whether applied to the present form or to our American plants in general as the name implies, I have no means of knowing. Moore gives as a synonyme var. B. of *Lastrea dilatata*, a fern generally regarded as a distinct species by English authors.

But whatever may have been its application in that form, in bringing it forward here under the present combination, it becomes an entirely new and as much an original name as if it had never been used at all.

I have been led to restore *A. Boottii* to its specific value, and to retain Tuckerman's name for it from the following considerations:

The characters that seem to connect it with *cristatum* are, when more carefully examined, really no stronger than similar resemblances between other and good species.

For example, the sterile fronds of *A. munitum* of the Pacific States, and our northern *A. acrostichoides* are quite as much alike as the sterile fronds of *Boottii* and *cristatum*. Our common *A. marginale* and the Californian *A. argutum* sometimes so closely resemble each other as to suggest a closer relation than is accorded to them. These two species and *A. filix-mas* often appear to run together, having many similar resemblances, yet they are all three undoubtedly good species. Similar and equally strong resemblances may be found existing between many other species, and the puzzling forms of the small Botrychia are sufficient to show how little dependence can be placed, at times, on external appearances alone.

It is sometimes difficult to distinguish small specimens of *Cheilanthes lanuginosa* from *Notholæna Parryi*, and not an uncommon thing for fronds of *Woodsia obtusa* and *Cystopteris fragilis* to become mixed through their close resemblance, and if this occurs among species belonging to entirely different genera, how much more likely is it to occur among closely related species. So that I cannot see why any argument drawn from such resemblances should have more weight in this instance than in those mentioned.

Few ferns are really more distinct than *A. Boottii*. Its individual character is even more pronounced than that of *A. inter-*

medium, and there is seldom any difficulty in distinguishing it at all times from all other ferns by which it may be surrounded. Its wide-spread distribution in this country and Europe (where it was first discovered and described as a species by Braun, under the name of *Aspidium remotum*, and where it seems to preserve its character no less distinctly than with us) entitles it to a higher consideration than that of a mere variety, and although its resemblances to *cristatum* are stronger than its resemblances to *spinulosum*, the glandular indusia keep it always distinct from the former species. In no instance known to me is there any record of glandular indusia occurring in *cristatum* while in *Boottii* they are always present.

Its anomalous character, however, occupying as it does an apparently intermediate position between *spinulosum* and *cristatum*, and the fact that it is generally found growing in company with those two species, has led many to regard it as a probable hybrid, but a proper consideration of this theory will show that while it may be possible for those two species to hybridize as frequently as this theory would pre-suppose, it is hardly probable that they should do so in so many instances, and under such widely different circumstances and surroundings without producing some other than this one particular form, everywhere so uniform in its character. But even this theory, if established, would only result in raising our plant to the dignity of a species, a position to which I think it no less entitled now.

I retain Tuckerman's name, as it is the only one by which our plant is generally known to American botanists, and having been used frequently abroad, it has the additional merit of being the best known and most widely used of all names.

Finally, if it be urged against my paper that, as my investigations have apparently been limited to Middlesex County, they can only be regarded as partial, I answer that those observations were made upon living plants growing in their natural situations, and other examinations of a series of herbarium specimens from Maine, Vermont, Massachusetts, New York and other States, have only strengthened my convictions in regard to them.

During a recent visit to Portland, Me., I visited a number of rich swamps in the neighboring towns and found *A. americanum* to be the prevailing form in that vicinity. I met with *A. spinulosum* but twice, and in both instances the specimens were well marked and characteristic.

Some of the specimens of *A. americanum* were remarkably large and fine, and might have been mistaken for *dilatatum*—with which form large specimens are no doubt often confounded—but a close examination revealed all of the characters that I have described as belonging to this species.

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PLASTER OF PARIS AS AN INJECTING MASS.[1]

BY SIMON H. GAGE, B.S.

THE necessity for some artificial, colored medium to fill the blood vessels must have been felt by the first anatomists. Indeed, injections were rudely made by Eustachius and Varolius in the sixteenth century (Turner, 1, I, 812).[2]

It was left, however, to De Graaf and Swammerdam to fairly initiate the process in the middle of the seventeenth century (Turner, 1, I, 812).

De Graaf used mercury and colored fluids, and was the inventor of the injecting syringe (2, XVII, 291); but it is to Swammerdam that anatomists owe most, for he introduced the use of colored wax (2, XL, 477 and 1, I, 812). This answers fairly the requirements of an injecting mass, as it may be used in the fluid state, but becomes solid very soon afterward. Upon renouncing anatomy for mysticism, Swammerdam gave his secret to Ruysch, his fellow countryman (2, XL, 477), who perfected the art, and fairly approached in skill and excellence of results the refinements of modern anatomy (1, I, 812, and 2, XXXVII, 143).

About the middle of the eighteenth century, Monro *primus* published an essay on anatomical injections (4), in which were given very precise directions for the manipulation and preparation of the injecting mass. It was composed of wax, tallow, oil and turpentine, colored with vermilion, verdigris or lamp-black (3).

In the latest works which treat of the technology of injections (5, 6 and 7), nearly the same formulæ for injecting masses are given; and except a mere mention of gypsum in Martin (7, II, 99), all coarse masses are solid at ordinary temperatures and must

[1] This paper is based upon investigations made in course of the preparation of a Manual for the Dissection of Cats, by Prof. Burt G. Wilder and the writer.

[2] See list of works referred to at the end of this paper. The first figure designates the number on the list; the last, the page; the middle, Roman numeral, the volume.

be heated before use. The subject must also be thoroughly warmed.[1]

Plaster of Paris has long been used as an injecting mass, in the medical schools of this country at least. It seems to be admirably adapted to this purpose from its well known property of becoming solid when mixed with water.

Although plaster has not the defects of the masses that require warming before use, there are difficulties in its manipulation. I have been unable to find anything upon the matter in books; and gentlemen connected with medical schools say they do not know of any printed directions; but this process of injecting, like other expedients is handed down by tradition from one demonstrator to another. All that I have been able to learn from others of the technology of plaster injections is that the plaster should be mixed to a thin paste with water (with a saturated aqueous solution of arseniate of soda at one medical school) and used, uncolored or colored with vermilion or red lead, very quickly before it has time to set.

The lack of precise information as to its manipulation, and the skill and certainty necessary to use simple plaster and water, from its rapid setting, render it hardly manageable by students. Yet it is so simple and excellent for coarse injections that some careful experiments were made, in the anatomical laboratory of the Cornell University during the last college year, to render it practicable, if possible, for the use of students by elucidating the following particulars:

1. The character of the plaster to be used.
2. The proportions of plaster and fluid.
3. The best and cheapest red and blue colors.
4. The means by which the plaster may be kept fluid ten to thirty minutes after mixing without preventing it from hardening finally.
5. The precautions necessary in making permanent the preparations injected with the plaster mass.

(1.) It was found that the very finest plaster is best, and indeed necessary if it is desired to fill the smaller vessels.

(2.) Equal volumes of plaster and fluid give the best results. This forms a very fluid mass which penetrates finely and sets firmly.

[1] According to Martin and Frey (7, II, 101 and 10.174), fine cold flowing injecting masses may be made by dissolving copal and mastic resin, with a small proportion of wax, in sulphuric ether, and coloring with red lead; or by dissolving the finest red sealing-wax in absolute alcohol. These masses harden as soon as the ether or alcohol soaks into the tissues.

A thicker mass is much more difficult to manage. A slightly greater proportion of fluid may be used if the finest vessels are to be filled. The fluid includes all the liquid used in mixing the mass; viz, coloring liquids, restrainers and water.

(3.) As to the red and blue colors, there are several that answer admirably. For red, vermilion or red lead ground in a mortar with a little water to get rid of lumps may be added in sufficient quantity to give a bright color. A saturated aqueous solution of magenta or red aniline is the easiest to use of all the red colors. It does not diffuse and color the tissues as one might expect, but colors the walls of the vessels a very bright red. An ammoniacal solution of carmine is, however, the best red. A sufficient quantity of this is added to the mass, and then the carmine is precipitated with fifty per cent. acetic acid. The acid should be poured into the colored mass, with constant stirring, till the color changes to the bright red of dry carmine, and there is a distinct odor of the acid. It is necessary to precipitate the carmine, as an alkaline solution diffuses through the walls of the vessels and stains the surrounding tissue. The advantage in precipitating the carmine in the mass is its uniform diffusion. The same method is employed in coloring red the finest gelatin masses for histological injections (9, 10 and 11).

A saturated solution of Berlin blue is the best blue, but as this is difficult to prepare (8, 403, 9, 164 and 10, 180), the ordinary Berlin or Prussian blue of the shops will answer if it is ground with water to a homogeneous paste. The simplest blue is, however, a saturated aqueous solution of blue aniline.

The aniline colors are the easiest to use, as it is simply necessary to add to the mass a sufficient quantity of the solution to produce the desired tint.[1]

(4.). It has been known a long time that if alum or borax is burned with gypsum, the resulting plaster will not set for three or four hours after mixing, but will finally set nearly as hard as marble (12). It is said by Tomlinson (13, I, 829) that ordinary plaster may be kept fluid four or five hours after mixing with water by adding a little *size* or beer; and it is a matter of common experience that the greater the proportion of water the longer it takes the plaster to set. It is necessary to give the mass a cer-

[1] Leamon's red and blue aniline dyes answer very well, and may be bought at any drug store.

tain consistency in order to have the resulting injection successful, therefore the amount of water could not be increased sufficiently to retard the setting over four or five minutes. As to the alum-plaster, it is difficult to obtain, and has the same objection as the mass to which *size* has been added; viz, it is too long in setting, for it is often desirable to begin a dissection in comparative anatomy almost immediately after the injection has been made.

It was noticed that a mass colored with carmine solution and afterwards acidulated with acetic acid remained fluid a much longer time than when colored with a red or blue with which no acid was used. Experiment showed that plaster mixed with an equal volume of ten per cent. acetic acid remained fluid ten to twenty minutes. The time was increased when carmine solution was used with the acid, as in practical injections, but not when any other colors were added. It was also found that if the plaster was mixed with either of the following solutions, instead of water, the setting was retarded ten to thirty minutes: A ten to twenty per cent. aqueous solution of alcohol or glycerine, or a ten per cent. solution of arseniate of soda. Either of these restrainers may be used with either of the colors. The arseniate and the acetic acid make the plaster friable, but the others do not.

It is important to state that a mass which has been treated with a restrainer may be kept perfectly fluid much longer by agitation. This is also true of plaster and water, but not in so great a degree.

In all of the experiments the plaster, after being thoroughly mixed with the fluid, was poured into small paper boxes like those used in imbedding for microscopical sections. It was found in practice that the plaster hardened much quicker in the blood vessels than in the paper boxes. This is probably because the restrainers and all superfluous liquid soak into the tissues, leaving only the amount of water necessary to crystallize the plaster.

(5.) If one desires to make a *permanent* alcoholic or dried preparation of any part or organ injected with plaster, the aniline colors must not be used, as they are not enduring. The alcohol should be seventy-five per cent. or stronger, and slightly acidulated with acetic acid (alcohol 200 parts, acid 1 part) to preserve the brightness of the Berlin blue and the carmine red (10, 202).

The part to be preserved should not be placed in alcohol till the plaster has become thoroughly hardened. An hour will usually suffice.

Practical Application of the Plaster Mass.—It will be readily seen that the plaster mass is far superior to a wax mass for ordinary work. It is simply necessary to mix it well with an equal volume of fluid; and the subject needs only to be bled. Wax involves great expense and trouble in preparation, and both it and the subject must be thoroughly warmed before the injection can be made (7, II, 100 and 3). The warming is objectionable especially with cold blooded animals.[1]

Plaster is also very neat, it never softens, but makes the injected vessels like cylinders of stone. It penetrates very finely, filling arteries half a millimeter in diameter, and has a great range of uses. It is well adapted to fill various ducts, like the thoracic, pancreatic, etc. The valves in the veins, the semilunar valves of the aorta and pulmonary artery may be most satisfactorily demonstrated with it, and with a little care and experience the action of the auriculo-ventricular valves of the heart may be nicely shown.

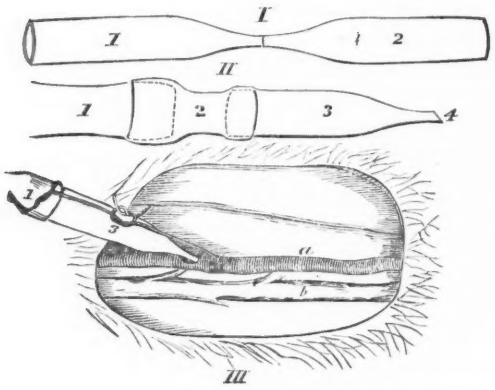
Vessels or ducts injected with plaster may be dissected out neatly, and placed on cardboard to dry. The appearance of the dried preparation is nearly like that of the fresh specimen, as the plaster prevents shrinkage. Preparations so made will last indefinitely if they are well poisoned with arseniate of soda before drying. Specimens injected with plaster colored with Berlin blue and carmine, have kept three months in slightly acid alcohol without the least change.

The accompanying diagrams are introduced to show the cheapness and simplicity of an injecting apparatus, and its practical application in plaster injecting.

An 8-ounce lead or britannia syringe, with a leather packed piston, works very well indeed and costs less than one dollar. The canula is so large, Fig. II, 1, that it cannot be put into the vessels. Fine canulæ for this purpose may be made by any per-

[1] It is objectionable to warm thoroughly a mammalian animal after death, as it greatly hastens decomposition. It is particularly objectionable to warm cold-blooded animals, for the warm water, into which they must be put, acts as a powerful stimulus, causing general tetanus, unless one waits half a day or a day after apparent death. The tissues, especially of *amphibians*, are greatly softened by the warm water, in fact partially cooked. It is also a great deal of trouble to warm the animal and the mass in summer.

son out of a small glass tube, as shown in Fig. I. The fine canula is connected with the canula of the syringe by means of a tightly-fitting rubber tube, Fig. II, 2.



EXPLANATION OF THE DIAGRAMS.

FIG. I.—1-2, a glass tube 6 mm. in diameter is evenly heated in the center over an alcohol or Bunsen flame, and drawn out till it is only 1–2 mm. in diameter. A scratch is then made with a fine file and the two are broken apart.

FIG. II.—1, the large canula of the syringe; 2, rubber tube serving to connect this large canula to the fine canula, 3; 4, the oblique end of the fine canula, made by carefully grinding with a fine wet file. The sharp edges at both ends of the glass canula may be removed by cautiously heating in the flame.

FIG. III.—The artery and vein of the left leg are exposed, and the artery is represented as ready for injection. To inject the body it is simply necessary to change the direction of the canula. *a*, femoral artery; *b*, femoral vein; 1, surgeon's knot on the large end of the canula; 2, insertion of the canula into the artery; 3, knot connecting the strings round the artery and the large end of the canula.

All the knots shown in the figure should be hard knots like 3.

In order to inject, the given vessel or duct is exposed and a longitudinal slit made in it. The fine canula connected to the rubber tube, Fig. III, is put into the vessel, and a string tied in a hard knot around the vessel so that it will press on the canula. One end of this string is then tied to another string coming from the large end of the canula, Fig. III, 1. This prevents the canula from slipping out of the vessel.

After the canula has been tied into the vessel, the injecting mass is prepared. Let it be for the arterial system of a cat. 100 cc. of the finest plaster of Paris is put into a clean dish, and 84 cc. of a ten per cent. aqueous solution of alcohol, glycerine

or arseniate of soda is added, and the whole well mixed. Then 8 cc. of carmine solution is stirred into the mass, and finally 8 cc. of fifty per cent. acetic acid is poured in with constant stirring. The fine canula and rubber tube are filled with water to avoid getting air into the vessels. The syringe is then filled with the prepared plaster mass and the large canula of the syringe is connected to the fine canula by means of the rubber tube. The pressure should be *steady* and *continuous*. There is very little danger of bursting arteries if the pressure is steady.

Before the injection is commenced, a string should be put around the artery beyond the end of the canula and loosely knotted with a surgeon's knot. (In a surgeon's knot the string is put through the loop twice as shown in Fig. III, 1.) As soon as no more mass can be forced into the vessels the surgeon's knot should be tightened, and the fine canula and syringe thoroughly washed with water. All the dishes used in making the injection should be washed immediately before the plaster hardens. The most scrupulous cleanliness is necessary to prevent lumps of hardened plaster from clogging the syringe or the vessel which is being injected.

In case veins are to be injected they should be, as far as possible, emptied of blood, and the injection must be made from some peripheral vessel like the femoral or jugular veins, on account of the valves. It is well if the injection is made into the femoral vein, for example, to have the jugular open to allow the blood to flow out as the plaster is forced in. There is no danger of the plaster running out, for it cannot pass the valves.

As a rule a dissection may be begun in half an hour after the injection.

FORMULÆ FOR PLASTER MASSES.

The amounts given are those necessary for an ordinary cat, and cost two to five cents:

1. Finest plaster of Paris.....100 cc.
   Red lead or vermilion..... .... 50 grams.
   Either of the following restrainers.....100 cc.
   Ten to twenty per cent. aqueous solution of alcohol or glycerine, or a ten per cent. solution of arseniate of soda.
2. Plaster. .....100 cc.
   Restrainer..... 84 cc.
   Ammoniacal solution of carmine..... 8 cc.
   (Dry carmine 1 gram, ammonia 2 cc. Grind the two in a mortar and add 22 cc. of twenty per cent. glycerine,)
   Fifty per cent. acetic acid..... 8 cc.

3. Plaster..... 100 cc.
Saturated aqueous solution of magenta or aniline red..... 25 cc.
Restrainer..... 75 cc.

4. Plaster..... 100 cc.
Berlin blue in powder..... 2 grams.
Restrainer..... 100 cc.

5. Plaster..... 100 cc.
Saturated aqueous solution of aniline blue..... 10 cc.
Restrainer..... 90 cc.

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ON THE NATURAL SUCCESSION OF THE DICOTYLEDONS.[1]

BY LESTER F. WARD, A.M.

THE system of classification for dicotyledonous plants now in use in most text books of botany is substantially that of Antoine Laurent de Jussieu, as published in his *Genera Plantarum* in 1789. Although many minor modifications have been made and are still being made by different authors, the fundamental arrangement into three "Divisions," depending on the nature of the corolla, has been maintained in its integrity to the present

[1] A sequel to the article on the *Genealogy of Plants* in the June number. The substance of the two articles was embodied in a paper read before the Philosophical Society of Washington, February 16, 1878.

day; only two serious attempts having yet been made to cut loose from it, one of which has failed to command acceptance, notwithstanding the eminence of its author, while the other is still too new to permit an opinion as to its ultimate success. I refer to Dr. Lindley's classification as elaborated in his *Vegetable Kingdom*, and to the system proposed by Sachs in his *Text Book of Botany*.

In the first,[1] or, as it is supposed, highest of the three "Divisions," the corolla consists of distinct pieces or *petals* not at all connected with each other, and this is called the Polypetalous division. In the second group these petals are united, at least at their base, the distinct divisions only appearing, if at all, in the form of a "limb" of separate lobes at the summit of a tube of greater or less length. This group is called the Monopetalous division. The third group wants the petals and corolla entirely, the perianth consisting of a single envelope which is always assumed to be the outer or calyx Plants of this nature form the Apetalous division; they are also frequently denominated monochlamydous, those of the other two divisions being designated as dichlamydous.

The defects of this classification have long been apparent, and although so persistently adhered to, it has always been a source of trouble to systematists, no two ever entirely agreeing as to its precise limits. Even those who wholly ignore or reject the doctrine of descent seek to bring together as nearly as possible those plants which actually resemble each other most, since this is the fundamental idea, and formerly the only idea, of a "natural system." Yet in adhering to the principle involved in the classification by divisions this was frequently impossible, the two principles being often in direct conflict. In every such case it is clear that the maintenance of the divisions involved, is so far, an *artificial*, as contradistinguished from a *natural* system of classification. And indeed it is difficult to see how a system of classification based on the corolla is more natural or less artificial than one based on the stamens. If it could be shown that this class of characters are

[1] The propriety of commencing text books of Botany or Natural History with the highest or most perfectly organized families and descending the scale so as to end with the lowest or most imperfectly organized may well be questioned. Though doubtless more convenient for beginners to study, it tends to antagonize and keep out of view the truth of a progressive historical development in living things which, to the majority of students, is of greater value than any technical acquaintance with specialized forms.

more permanent or reliable, or that they are more comprehensive, and better typify the general sum of the characters distinguishing groups of plants, a point in their favor would be gained, but, as we shall see, such is not the case. In point of fact these characters frequently change when nothing else has changed, and often remain the same when everything else widely differs. They constantly tend to "run together," and no strict dividing line exists between them. They also frequently vary within very narrow groups, sometimes in the same species or individual. Critically viewed, therefore, this system so far as it goes, presents as many imperfections and stands as directly in the way of the adoption of a truly natural system as did the professedly artificial one of Linnæus.

The recognition of the three Divisions, as is made in nearly all systematic works on botany, even the most recent, involves numerous direct conflicts with the best established orders of dicotyledonous plants. Many orders are found to contain species and genera whose corollas would require them to be placed in a different Division from that in which the order itself has been placed. Examples of this class are abundant. *Paronychia*, a genus which seems clearly to belong to the polypetalous order *Caryophyllaceæ* (*Illecebreæ*), is usually apetalous, though some species retain a rudiment[1] of the petals in the form of minute teeth or bristles; *Chrysosplenium* in the order *Saxafragaceæ* is another example of the same class. *Glaux* in the monopetalous order *Primulaceæ* is destitute of a corolla. *Ludwigia*, *Ammannia*, *Penthorum*, *Nyssa*, are further illustrations, and only the most familiar need be mentioned. Most of the *Euphorbiaceæ* in this country (if we except *Euphorbia* itself), which are monœcious, have polypetalous staminate (male), and apetalous fertile (female) flowers. Here we have the two extreme divisions united in the same individual plant (*Croton*, *Tragia*, etc.).

[1] The term "vestige" would probably be more correct. It is certainly remarkable that this term has not been more generally adopted to express this important distinction so clearly perceived by the naturalists of this epoch. The terms "rudiment" and "rudimentary" should be confined to those organs which the life-history of the plant or animal shows to be in process of development or formation. On the other hand those organs which, from disuse or other causes, have dwindled into mere remnants of once perfect ones should be distinguished by the term "vestiges" or an equally appropriate and expressive one. Yet these are the so-called "rudimentary organs" which have played so great a *rôle* in the modern theories of science, and Mr. Darwin himself employs this expression in that sense without commenting on its bad etymology.

Again, there are cases in which the lobes of the nominally gamopetalous corolla are so deeply parted that it becomes difficult to determine whether they are at all united, and in which the union sometimes actually ceases to exist. Of this class might be mentioned at random *Symplocos*, *Statice*, *Naumbergia*, *Anagallis*, *Chionanthus*, *Fraxinus*. The last named genus is of special interest in consequence of the close general resemblance between the ash and maple families, which are, however, widely separated in the present system. That beautiful climber, *Boussingaultia baselloides*, commonly known as the Madeira vine, is botanically related to the *Portulacaceæ*, but the petals are barely united at the base, for which reason it has been removed from its natural association and placed in the monopetalous division.

Thus we find that while some botanists have preferred to maintain well established orders intact by allowing them to embrace genera and species whose corolla would require them to be placed in different divisions, others have chosen rather to remove such anomalous genera to their appropriate divisions and if necessary to create new orders for them. Some, for example, leave *Paronychia*, *Anychia*, etc., in the *Caryophyllaceæ*, with which they are clearly allied, while others place them in the apetalous division near the *Polygonaceæ* with which they doubtless are also allied. But there are many cases which cannot be thus easily disposed of, as the *Aquifoliaceæ*, *Euphorbiaceæ*, *Asclepiadaceæ*, etc., in which cases the entire order is changed about from one division to another, according as the author may think the preponderance of characters requires.

Not only does it frequently occur that an order which cannot be divided contains genera representing two of the general types of corolla upon which the divisions are founded, but some orders, as the *Primulaceæ*, actually embrace all three of these types. In the order just named we find *Naumbergia* which is frequently polypetalous, and *Glaux* which is always apetalous, while most of the genera are monopetalous.

These few examples, which might easily be extended, certainly show that the so-called divisions of the *Dicotylæ* do not form a natural series. They rather indicate that they represent three parallel and co-ordinate series, in any one of which orders closely corresponding may be named in one or both the others. Thus the *Caryophyllaceæ* may be compared with the *Polygonaceæ*, the *Acer-*

inæ with the *Oleaceæ*, the *Aquifoliaceæ* with the *Rhamnaceæ*, the *Malvaceæ* with the *Euphorbiaceæ*, and the *Hamamelaceæ* with the *Platanaceæ*. These comparisons and others that will suggest themselves to every botanist, reveal natural relationships between plants which are far removed from each other because they fail to agree in the one character on which the divisions are based. They clearly show, therefore, that the arrangement by divisions is an artificial one, and that the fact of the coherence or non-coherence of the petals is far from a reliable one as indicating the true succession, much less the genealogical descent of the families.

It is not claimed, however, that the three mostly parallel series wholly fail to express any general law of the vegetable kingdom, and an attempt will be made before concluding the subject to show that they do express in a partial manner an important truth in phytonomy. Though concurrent for a great part of their length and inosculating all along, these lines of development appear not to have had a simultaneous origin. But before entering upon the direct treatment of this problem it will be necessary to consider another class of facts.

The practice thus far dwelt upon of distorting the natural system by an undue regard for the corolla is only one example under a general class. The vice itself expressed in general terms, is that of adhering too closely to any one character to the neglect of all the rest. We thus find cases within the same division in which orders unquestionably allied are not placed together, but are widely separated. Every one has been struck by the resemblance of certain Ranunculaceous with certain Rosaceous plants, especially as to foliage and general habit; for example, *Ranunculus* with *Geum*, *Actæa* with *Spiræa*, etc. It is customary with botanists to affect a certain degree of contempt for such general resemblances, and they are commonly regarded as wholly misleading. That they cannot be depended upon as safe guides to special investigation all will of course admit, since it so frequently happens that striking similarities exist between families which cannot in any way be assimilated. But even in such cases the resemblances often vanish on closer inspection and prove to have been produced by entirely dissimilar processes. General resemblances which will bear close inspection are rarely without a meaning. There is a certain correlation which subsists

among all the characters of a plant so that those which have similar organs of reproduction usually exhibit strong family relationships. Were it not so familiar it would be a surprising fact that a Solanaceous plant can usually be detected as such without examining the flowers, merely by a certain undefinable appearance which belongs to the family. The same is true to a greater or less extent with all the large orders, *Cruciferæ*, *Borraginaceæ*, *Urticaceæ*, etc. In some families still more subtle characteristics persist with great uniformity, of which the peculiar odor of the *Orchidaceæ* is a good example.

This so-called "general aspect" is in reality the *ensemble* of all the characters which make a plant such as it is, and though any one character is as liable to vary as another or as more obvious ones, their number is so great that it requires an enormous period of time to so efface them all as to destroy all traces of resemblance. Not so of any particular character which botanists may fix upon. This may vary in a manner comparatively rapid, and thus it doubtless often happens that species really related and bearing a general resemblance are divorced in the text books on special differences.

This co-existence of so large a number of minor peculiarities as to give to two plants or groups of plants an obvious general resemblance should therefore be welcomed as a valuable accessory to the work of classification, not as a special guide to truth but as a general check upon error. A strong *physiognomic* resemblance between two groups of plants should at least raise a suspicion of their genetic relationship, and might frequently furnish a theory for the investigation of important questions. In a previous paper it was shown how the physiognomy of the *Cycadaceæ* pointed to their natural position between the ferns and the palms, and how a closer inspection of the more reliable characters sustained this conclusion. If now we return to the case of the *Ranunculaceæ* and *Rosaceæ* above referred to, we shall find a further confirmation of this law. A careful comparison of all the genera of these two orders, which has been recently made, reveals the fact that there is to be traced "an easy transition from the wholly conical and much elongated receptacle of *Ranunculus* and *Myosurus* to that of *Fragaria*, flattened at the base and conical in the center, or of *Rubus* with its raised margin and convex center. From this we may pass to *Sibbaldia*, *Potentilla*, *Horkelia* and

Stylobasium."[1] On the same principle the *Portulacaceæ* have been very closely assimilated to the *Cactaceæ*, with which they are found to agree in an astonishingly large number of characters, including that of the irritability of the stamens. Again the *Droseraceæ* and *Saxifrageæ* are now known to be closely allied families, as their physiognomy would indicate. And strange as it may at first appear, there is little doubt that the *Cruciferæ* are related to the *Onagraceæ* by natural affinities more or less close. Further investigations from the same point of view will doubtless enable us to go much farther in discovering the true affinities of dicotyledonous plants.

It is undoubtedly the special function of the floral envelopes, as it is of the ovary, to protect the germ, and the degree of this protection is the most reliable index we have to the degree of advancement in vegetal life. The means employed in securing this end in the *Dicotylæ* are two-fold: first, the relation in which the calyx stands to the ovary; and second, the character of the inner envelope or corolla. Botanists, while they have not ignored either of these essential characteristics, have generally placed more weight upon the second than upon the first, although for the purpose named the first has doubtless been of equal service to plants.

From the hypogynous to the perigynous, and from this to the epigynous calyx-tube, there is certainly a steady progress in the direction of protection, and the advance of the calyx towards the more complete enveloping of the ovary may be regarded as indicating an equivalent advance in organization. In Dr. Lindley's great work on *The Vegetable Kingdom*, this was made the leading character, although in his earlier works he had followed the system of Laurent Jussieu; and Prof. Julius Sachs in his *Text Book of Botany*, though in most respects making an entirely new departure in botanical classification, places the *Rosaceæ*, *Onagraceæ*, *Myrtaceæ*, and other strictly epigynous families at the head of the system as representing the highest type of development.

The classification by divisions, on the other hand, professes to give special prominence to the corolla as an index of progress, but how obscure the notion of any direct advantage to be derived from it to the plant must have been with the founders of that sys-

[1] Baillon, Histoire des Plantes.

tem, is shown by the order in which the divisions were arranged. It seemed evident to their minds that those plants which were wholly destitute of a corolla, the apetalous or monochlamydous division, should stand at the base, and thus far they were certainly consistent. But in placing the polypetalous division at the head of the system, the idea of its protecting function must have been quite forgotten. For unquestionably the monopetalous corolla is the form of floral envelope which affords the greatest protection to the ovary and stamens, and the more nearly this approaches to the tubular form the more complete is that protection. The distinct, usually spreading, and often fugacious petals of polypetalous plants are of very little service in this respect, so that, in so far at least as this one principle is concerned, they should certainly stand next above the *Apetalæ*.

In this respect too, it is true, certain monocotyledonous plants would take a higher rank than some apetalous and polypetalous *Dicotylæ*, their tubular perianths forming better protecting envelopes. But as it is the genealogical series that the new taxonomy seeks, other more fundamental characteristics must preclude all attempts to derive the *Monocotylæ* from any advanced stage of the *Dicotylæ*.

The general truth, which is becoming more and more apparent, is that the floral envelopes cannot alone be relied upon to indicate the course of development of the Dicotyledons, and that for the natural arrangement of the families many other considerations must be taken into the account. Instead of depending upon any one character it is necessary to consider all the characters together. The task, it is true, is vastly more difficult, and systematic botany becomes a science requiring exhaustive study, but the conclusions reached will be correspondingly more valuable.

One of the best checks by which the genealogical systematist may frequently orient himself, is what has been called the "physiognomy" of plants. Whenever the pursuit of any particular character or set of characters is found to have brought into close proximity plants of a totally different physiognomy, it is generally safe to conclude that the process has been carried too far; and on the other hand, when, as is frequently the case in the present system, plants having strong general resemblances have been widely separated, the propriety of reviewing the evidence

on which such separation was based is at least strongly suggested. The resemblance, above pointed out, which the *Caryophyllaceæ* bear to the *Polygonaceæ* illustrates this. In these orders the corolla and the ovary, two of the most reliable characters, are sufficiently distinct in typical genera to justify a separation, but when led by the stipules, swollen joints, leaves, habit, and other peculiarities that combine to make up their general appearance, to place them in juxtaposition and study them comparatively, we find that even these characters fail in certain genera, while the relationship indicated by the physiognomy is partially supported by more respectable evidence. We have already seen that several members of the chickweed family are apetalous. On the other hand some genera of the *Polygonaceæ* may be regarded as at least functionally dichlamydous, as in *Chorizanthe*, the one-flowered involucre closely imitating a calyx. And further, the capsule of several genera of the *Caryophyllaceæ* (*Paronychia*, *Anychia*, *Scleranthus*) is reduced to a one-seeded utricle approaching the achenium of the buckwheat family.

While, therefore, the time has not yet arrived for the attempt to be made to trace out the line of genealogical descent of the Dicotyledons, it is evident that a complete re-adjustment of the orders, to a great extent independently of the present divisions, will have to be made and might soon be undertaken.

The first dicotyledonous plants were in all probability apetalous, and all authors agree in placing the *Amentaceæ* (*Juliflores* of Sachs) at the bottom of the scale. It is certainly not without significance that the *Casuarineæ*, whose possible descent from the *Gnetaceæ* (*Ephedra*) was referred to in the previous article, belong to this group.

The origination and development of the corolla was doubtless by a process similar to that by which the calyx was formed. In both cases it was the advantage, however slight, which the plant derived from it that occasioned its progressive development into a protecting organ. In the *Amentaceæ*, as also in many *Monocotylæ* (*Cyperaceæ*, *Gramineæ*), these envelopes are very imperfect, often reduced to mere scales. Polypetalous plants (and doubtless apetalous also) may be of two kinds, according as the petals may be shown to represent rudiments of a gamopetalous corolla in process of development, or only *vestiges* of one which they formerly possessed. The terms "polypetalous" and "monopet-

alous" do not properly designate the process by which these organs are developed. According to the accepted principles of phyllotaxy, each petal (as also each sepal) represents a transformed leaf; but the embryological study of those plants in which the corolla takes the form of a tube, has proved that this has not been produced by the union of the original petals, but by the formation at first of a ring at their base which acquires greater prominence until it eventually assumes the character of a tube. To better indicate this process the terms "eleutheropetalous" and "dialypetalous" are employed by certain authors to denote that the petals are distinct, the term "gamopetalous" being used for the very objectional one "monopetalous."

If natural selection has had anything to do with the development of these organs, it is certain that the free petals must have historically preceded the tube, and hence we may conclude that for the earliest forms of each division the order of succession was: first, *Apetalæ*; second, *Eleutheropetalæ*, and third, *Gamopetalæ*, and therefore to whatever extent these divisions may now be parallel and coördinate, they were not so at the outset.

If, therefore, we were to accord to the general principle of protection, as above pointed out, its full force in the classification of dicotyledonous plants, at the same time keeping in view certain subordinate laws by which it is qualified, we should probably find, in attempting to reconstruct the present system, that while the so-called divisions would be virtually abolished and the orders within each very much blended and intermixed with those of the others, there would still remain an ascending series based on the perfection of the floral envelopes, and in which as now those plants classed as apetalous would in the main stand at the base. The intermediate terms of this series would, however, unlike the present system, consist chiefly of those orders now placed in the polypetalous division, while the highest of these terms would be represented by the monopetalous orders with tubular corollas. This arrangement would be further modified by the relation of the calyx to the ovary and minor considerations. In fact, if the true genealogy of the *Dicotylæ* is ever worked out it will doubtless be found to conform to the general law in all departments of life, and to assume the arborescent form, whose ultimate ramifications it would be wholly impossible to trace in the present state of the science.

Very little more than this can at present be predicted with regard to what the true "Natural System" really is, which we are still so far from understanding; but it would seem from the peculiar character of *Compositæ*, and especially from the double safeguard of their narrowly tubular corollas, their epigynous calyx (*pappus*), and syngenesious anthers, still further secured by the massing of the flowers into dense heads, that this order, which is also the largest in the vegetable kingdom, should be regarded as the highest and most specialized family of plants, and might be fitly made to crown the natural system.

The general arrangement above outlined is further substantiated by the limited data which palæontology affords. The greater part of the fossil plants of this class have been found in the Cretaceous formation. They nearly all belong to the apetalous and polypetalous Divisions, but by far the greater number to the former; such genera as *Salix*, *Quercus*, *Platanus*, *Sassafras*, etc., occur most frequently, and some of these have been traced to the lowest Cretaceous strata if not to the Jura. That they existed in still earlier times can scarcely be doubted, and high authorities have fixed upon the Trias as the probable epoch in which the earliest dicotyledonous genera made their appearance. In the Upper Cretaceous certain polypetalous genera begin to be found, among which are numbered *Magnolia*, *Liriodendron*, *Prunus* and other multi-staminate plants, most of which have been assigned a high rank in the current system. This fact and others seem rather to indicate that a great many stamens and an elongated receptacle are marks of a low organization, as if just emerging from the catkin-stage. Very few gamopetalous plants are found fossil, strongly implying that they belong to late Tertiary periods. Especially significant is the absence of those having elongated tubular corollas, while it is believed that the first fossil *Composite* plant is yet to be discovered.

Little, therefore, as is really known of the natural succession and actual genealogy of the Dicotyledons, we may, nevertheless, fairly claim to have acquired sufficient data to warrant entering upon the investigation of this difficult and complicated problem, a task which must owe a great share of its success to the aid to be rendered by a rational hypothesis.

A STUDY OF THE POPULAR NAMES OF THE MENHADEN.

BY PROFESSOR G. BROWN GOODE.

THE menhaden, *Brevoortia tyrannus* (Latrobe) Goode, has at least thirty distinct popular names, most of them limited in application within narrow geographical boundaries. To this circumstance may be attributed the prevailing ignorance regarding its habits and migrations, which has perhaps prevented the more extensive utilization of this fish, particularly in the Southern States. It accounts for the extraordinary blunder of the compilers of the fishery statistics of the census of the United States for 1870, in which the oils produced from the white-fish of the great lakes (*Coregonus albus*) and the white-fish of Connecticut are classed as identical, a blunder which is followed by a number of others of the same character and quite as certain to mislead. The discrepancy of local names also enables us to understand how the extensive manufacturing interests and fisheries connected with this fish have gradually sprung up, little noticed save by those directly interested in the business.

In Maine and Massachusetts the name "pogy" is almost universally in use, though in the vicinity of Cape Ann it is partially replaced by "hard-head" and "hard-head shad." The name "menhaden" is exclusively applied in Southern Massachusetts, the Vineyard sound, Buzzard's bay and Narragansett bay where it appears to have originated. From the eastern boundary of Connecticut to the mouth of the Connecticut river the name "bony-fish" predominates, while in the western part of the State the species is usually known as the "white-fish." In the waters of New York the usage of two centuries is in favor of "mossbunker," a name which also holds throughout New Jersey. In Delaware bay, the Potomac, and Chesapeake bay other variations are found in "alewife" and "greentail." Virginia gives us "bugfish" in its various forms, while in North Carolina we first meet the name of "fat-back," which is more or less prevalent as far south as the St. John's river, Florida. In all the Southern States, especially in the vicinity of Beaufort, N. C., the names "yellowtail" and "yellow-tailed shad" are occasionally heard. I am informed that in the Indian river, Florida, the fish is occasionally called the "shiner" and the "herring."

Among the manufacturers in Port Monmouth, N. J., who prepare the menhaden as an article of food, a number of trade names are in use, such as "American sardine" (in distinction from the European fish which is prepared in a similar manner), "American club-fish," "shadine," and "ocean trout."

These names are not separated in their distribution by sharply defined boundaries. Still, as a glance at the table will show, the *habitat*, if that term may be legitimately used, of each local appellation appears to be clearly marked. Where there is a discrepancy it can usually be explained. For instance, the general use of the name "menhaden" in the vicinity of Boothbay, Me., is due to the presence of a large number of fishermen and laborers from Rhode Island who carry on the oil-factories in that region. In the same way the name "bony-fish" has been naturalized at Montauk point and Napeague, N. Y. The factories in that neighborhood are owned by firms in Eastern Connecticut, and the Connecticut "bony-fish fleet" has a favorite cruising ground in the waters of Eastern Long Island. The names "menhaden," "bony-fish" and "moss-bunker" have been introduced into Florida by northern fishermen, who prosecute the winter shad fisheries on the St. John's, and these same names are more or less familiar all along the coast wherever the northern coasters and fishing vessels are known.

The adoption of some one suitable name for popular use is eminently desirable. "Menhaden" is the name most generally known, as well as the most distinctive. It has the additional recommendation of having been derived from an aboriginal language. It has been used in the titles of the two manufacturers' associations, and it is hoped that this usage will soon be conformed to by all.

A few words concerning the origin of the above-mentioned names may not be out of place. "Pogy" and "menhaden" are derived somewhat remotely from the Indian dialects of New England, the latter apparently from that in use in Massachusetts and Rhode Island, the former from a more northern source.

For the explanation of the derivation of these names I am indebted to Prof. J. Hammond Trumbull, who writes, "*Munnawhatteaûg* corrupted to *Menhaden*, means, literally, 'fertilizer' ('that which *manures*'). This name was applied to the herring and alewife as well as the 'menhaden' proper—all these species being used by the Indians for manuring their cornfields.

"In the northern and eastern parts of New England the *Brevoortia* is commonly called *Pauhagen*, and probably in some localities 'poghaden' (as you write it and which is nearer the Indian original), though I have not heard it so pronounced by eastern fishermen. This name in the eastern dialects has precisely the same meaning as 'menhaden' (or rather *munnawhatteaûg* in Southern New England). The Abnaki (*i. e.*, coast of Maine) name was *Pookagan* as Rasles wrote it, and the verb from which it is derived he translated by 'on engraisse la terre.'"

According to Mr. J. V. C. Smith, the older fishermen of Northern Massachusetts, New Hampshire and Maine called the fish by the Indian name "pauhagen," and I myself have heard it called "poghaden" by old fishermen about Cape Cod. The modern name may easily have been derived from this by dropping the final syllable. At the present day this name is almost universally in use among the fishermen north of Cape Cod, though it is occasionally varied by "poggie" and "porgy." The use of the latter name should be carefully avoided: the same name, a corruption of the Indian "scuppaug," being commonly applied to another fish, the "scuppaug" or "scup" (*Stenotomus argyrops*).[1] As may be supposed, the name of Narragansett origin is most exclusively used in Southern Massachusetts and on the shores of Narragansett bay, the former home of that tribe of Indians. In its present form it first appeared in print in 1792, in the New York Agricultural Transactions, in an article by the Hon. Ezra L'Hommedieu.

"Hard-head" and "bony-fish" explain themselves, both referring to the same peculiarity of structure. The former name was first used about 1813 by Belknap in his History of New Hampshire; the latter, as well as "white-fish," by President Dwight in his Travels in New England.

The application of "white-fish" is also sufficiently evident, although this name is not a distinctive one, being applied to a large group of North American fresh-water fishes, the *Coregonidæ*, and in certain localities to the blue-fish (*Pomatomous saltatrix*). In England the term "white fish" is used to designate cod, had-

[1] This probably misled De Kay, who stated that the menhaden were known at the eastern end of Long Island as "skippaugs." He also remarked that "pauhagen" (pronounced *Pauhaugen*) was the Narragansett epithet, while "*menhaden*" was that applied by the Manhattan Indians.

dock, hake, ling, pollock, soles, turbot, plaice, halibut, and whiting.

"Mossbunker" is a relic of the days of the Dutch colony at New Amsterdam, and the name is still lovingly retained by the inhabitants of Manhattan island. It was in use as early as 1661, as we learn from an allusion in Jacob Steendam's poem in "Praise of New Netherland" (*'t Louf van Niew Nederland*).[1]

Allusion has already been made in the letter of Prof. Trumbull, to the great schools of "marsbanckers" seen by Dankers and Sluyter on their visit to New York, in 1679, and every one remembers the reference to this fish in Irving's "Knickerbocker," in connection with the death of the renowned trumpeter, Antony Van Corlear, where the name first appears crystallized in its present form.[2]

The derivation of this name may be easily traced, it having evidently been transferred by the Dutch colonists from the scad or horse-mackerel, *Caranx trachurus* (Linn.) Lacepede, a fish which annually visits the shores of Northern Europe in immense

[1] This poem, cited by Prof. Trumbull in the Report of the Commission of Fish and Fisheries for 1871–'72, p. 168, was printed, with an English translation, by Hon. Henry C. Murphy, for the Bradford Club of New York (Anthology of New Netherland: Bradford Club Series, No. 4, 1865, pp. 52, 45).

The allusion to the Mossbunker is as follows:

"Swart-vis, en Roch, en Haring, en Makreel
Schelvis, Masbank, en Voren die (se veel)
Tot walgins toe, de netten'vuld: en heel
Min ward ge-eeten."

"The black and rock fish, herring, mackerel,
The haddock, mossbanker, and roach, which fill
The nets to loathing; and so many, all
Cannot be eaten."

[2] "It was a dark and stormy night when the good Antony arrived at the creek (sagely denominated Haerlem *river*) which separates the island of Mannahatta from the main land. The wind was high, the elements in an uproar, and no Charon could be found to ferry the adventurous sounder of brass across the water. For a short time he vapored like an impatient ghost upon the brink and then, bethinking himself of the urgency of his errand, took a hearty embrace of his stone bottle, swore most valorously that he would swim across in spite of the devil (Spyt den Duyvel), and daringly plunged into the chasm. * * * An old Dutch burgher, famed for his veracity, and who had been a witness of the fact, related to them * * * that he saw the duyvel, in the shape of a huge moss-bonker, seize the sturdy Antony by the leg and drag him beneath the waves. * * * Nobody ever attempts to swim across the creek after dark, and as to the moss-bonkers, they are held in such abhorrence that no good Dutchman will admit them to his table who loves good fish and hates the devil."

A History of New York * * * By Diedrich Knickerbocker. New York, 1809.

schools, swimming at the surface in much the same manner as our *Brevoortia*, and which is known to the Hollanders as the *Marsbanker*.[1]

In the Museum Ichthyologicum of Gronow, published in 1754, the name *Marsbanker* is used in speaking of a scomboid fish, frequently taken with the herring, probably the same referred to above.[2]

The name is variously spelled "moss-bunker," "moss-bonker," "mass-banker," "mouse-bunker," "marsh-bunker," "marsh-banker," and "morse-bonker," and is also familiarly shortened into "bunker," a name in common use at the eastern end of Long Island.

The name "alewife" was given by the Virginia colonists to this species from its resemblance to the allied species known by that name in England. This name is preoccupied by the *Pomolobus pseudoharengus*, and should never be applied to *Brevoortia*.

The presence of a parasitic crustacean (*Cymothoa prægustator*) in the mouth of *Brevoortia*, when found in southern waters, explains the name "bug-fish" prevalent in Delaware and Chesapeake bays, the Potomac and Rappahannock rivers, and the inlets of North Carolina, with its local variations of "bug-head." and "buggy-head."[3] "Yellow-tail," "yellow-tailed shad," and "green-tail" refer to the yellowish-green tint of the caudal fin, observed only in Southern specimens. The former of these names has led to some confusion among our correspondents, the same name being applied in Georgia and Florida to a very different fish, *Bairdiella punctata* (Linn.) Gill.

An allusion to the oily nature of the flesh is found in "fat-back," a name in general use in the Southern States. This name is sometimes applied in Northampton county, Virginia, to the mullet (*Mugil lineatus*). In the last century it was used for the *Albula vulpes*.

[1] See Schlegel, Die Dieren van Nederland, Visschen, p. 4.

[2] 80. *Scomber* linea laterali aculeata, pinna ani ossiculorum triginta, *Arted. gen.* 25, n. 3. *Synon.* p. 50, n. 3.

Scomber linea laterali curva, tibellis osseis loricata, *Gronov. act. ups.* 1742, p. 83, ibique defer. Trachurus, *Bossuet*, ep gr. p. 74, *Bellon. Aquat.* p. 180, *Dale.* Hist. of Harw., p. 131, n. 5.

Belgis *Marsbanker* Frequentissime in Mari Septentrionale cum Clupeis p. 5, n. 4, descriptis capitur. op. cit. p. 34.

[3] Captain Atwood states in the Proceedings of the Boston Society of Natural History, x, 1865, p. 67, that the half-grown menhaden are called "bug-fish" by the Virgin a negroes, because they believe them to have been produced from insects, sin e they never find spawn in them there.

ABOUT WEEDS.

BY W. W. BAILEY.

WHAT is a weed? Generally speaking it is any plant that interferes with the operations of agriculture or gardening. Some plants are weeds because by their rapid growth they thrive to the exclusion of better things; others are so, simply from their unsightly appearance and their uselessness. There is never a question in one's mind as to whether a pig-weed (*Chenopodium*) is a weed or not. Its rank and homely growth, its inconspicuous flowers and its very limited uses, at once discard it from the catalogue of desirable plants. So is it with the burdock (*Lappa officinalis*), although this possesses elements of beauty to redeem it. Its large, crumpled leaves spring up in odd corners of yards, about houses, or on dust-heaps where little else would grow, and serve to cover disagreeable objects. The flowers, too, are very pretty, as all young people know who have woven them into parti-colored mats and carpets.

Perhaps weeds meet with less charity than any of God's creations. They are active enemies, not to be despised so much as hated. They are cut down or uprooted wherever found, or, if by chance overlooked, take possession of our entire grounds. So great a pest are they that man has taken them for the type of a rank and rapid growth. Yet, when curiosity leads us to observe them, there is much beauty in these simple plants which we ruthlessly tread beneath our feet. We might learn a useful lesson from the persistency with which they surmount all obstacles and survive every misfortune. The delicacy of taste, also, which leads a few to seek the richest soils or the sunniest exposure is worthy of our praise. And then, how social are they in their habits, forever seeking the improving society of their betters! They take such enjoyment in life, too, frolicking over the meadows, coquetting with their reflections in the brook, or climbing "where the air is delicate" upon the the eaves of our houses, where they remind us of Alice Pynchon's posies.

Many of them, were they only less common, would be highly prized. Indeed, it is at times difficult to draw the line between true flowers and weeds. Think what the dandelion would be were we not accustomed to its golden buttons and feathery globes! Look, too, at the luxuriant growth of the cotton-thistle

(*Onopordon*)! How prodigal is it of its material, as it throws out its silvery leaves and royal tufts of crimson. Those old Caledonian kings were fellows of good taste when they chose this noble plant as the floral symbol of a nation. Armed at every point it stands, like some sturdy Highlander, to repel aggressors.

The corn-cockle (*Lychnis githago*) and the cone-flower (*Rudbeckia hirta*) are both beautiful, as well as the flea-banes (*Erigeron*), daisies (*Leucanthemum*) and St. John's worts (*Hypericum*). Their only fault, and that is sufficient to condemn them, is that they will grow where nobody wants them. Our waste places would be deserts, indeed, did not nature kindly interpose to clothe them with these humble plants. Many species are unmistakably homely, yet even in the least showy there is much of beauty when the microscope is summoned to our aid. Flowers which seem too insignificant to be considered for a moment, will be seen when thus magnified to equal any of their prouder kindred, and to be as strangely and as wisely fashioned.

A weed which is troublesome in one place where the conditions are proper for its rapid extension, need not be so in another where those conditions are not fulfilled. Consequently we find that very different things are called weeds in the different portions of the Union, while some, like the shepherd's purse (*Capsella bursa-pastoris*) or the purslane (*Portulaca oleracea*), are of universal distribution. A plant may have flourished and multiplied in one locality, when if removed to another it will become restricted, and while useless, will no longer be regarded as a weed. The ox-eye daisy (*Leucanthemum vulgare*) comes to us from Europe, and although very beautiful to look at, is a great nuisance to the farmer: hay-fields in June are often made white with the showy heads of this troublesome plant. On the other hand, some of our weeds, like *Anacharis*, have invaded Europe, and some English weeds are rapidly supplanting the native flora of Australia and New Zealand.

Weeds are variously interesting according as they are viewed. If we keep a garden we will find the purslane an undeniable nuisance, and a vigorous enemy. If, on the other hand, we are indifferent to its invasions, and approach it as a friend, we will find it, together with most other weeds, possessed of beauties of which we had no conception.

We have already spoken of the beauty of the daisy, the bur-

dock, and some of the larger weeds. Let us now look at the smaller flowers, like those of the dead-nettle (*Lamium amplexicaule*), and any others of the mint family (*Labiatæ*). Some of the small *Cruciferæ* are also pretty, although they are weedy enough in appearance. The hedge-mustard (*Sisymbrium*) is the most pronounced weed that we know.

The little Veronica which we often find on grass-plats, has a most bewitching flower, which from its minuteness most persons would fail to observe. The corolla is white, and veined with the most delicate pencilings of violet, all pointing towards the center of the flower, so that we here gain beauty and information simultaneously. Its beauty is evident to any observer, but what does it teach? We have said that the colored veinlets all pointed to the center, and this, we believe, is true of all flowers where such markings occur, as shown a long time ago by Sprengel, who claimed that they serve as guides to the insect seeking nectar. Recent observations have proved his theory to be probably correct.

There is no more desirable ground for the beginner, than the waste places and open lots about our cities. Here he will find any number of plants with which it is well to become familiar. They can do no harm where they are, except by circulating their seed, and they are so little regarded by disdainful man that he can claim the whole collection as his own, and receive the municipal thanks for appropriating them. Side by side with the native and European weeds, we will sometimes find the prince's feather (*Polygonum orientale*), the Canary grass (*Phalaris canariensis*) and various other exotics. As the summer advances there will be a perfect tangle of weeds in such a place, evening primroses, *Datura stromonium*, *Lychnis*, melilots white and yellow, Canterbury-bells, amaranths, &c., some showy, others merely coarse and offensive. By the side of the streets we may find the homely cockle-bur (*Xanthium*) or the pretty moth mullen (*Verbascum blattaria*), with a white or yellow corolla, and stamens clothed with violet hairs. The common mullen (*Verbascum thapsus*) we will be sure to find, and if in New England, will meet the autumnal dandelion (*Leontodon autumnale*) which here blooms all summer. It is quite unlike the ordinary dandelion, and has branching green stems, smaller heads, and a tawny pappus. The *Polygonaceæ* present the common smart-weed, the knot-weed,

man's ever-present comrade, and the narrow-dock. More attractive plants are the wood-sorrel (*Oxalis stricta*), with its yellow bells closing as the sun declines, and with its light and graceful leaves, so pleasantly acerb; several species of clover (*Trifolium*) and *lucern* (*Medicago*); the Deptford-pink (*Dianthus armenia*), with its only star, and the celandine (*Chelidonium*).

To those who cannot take long walks, and who yet are interested in nature, we commend these weed gardens which are free to all. They will find a great number of families represented; a great many plans of growth illustrated; many beautiful blossoms, quaint seed-vessels, graceful grasses, and delicious odors, to reward them.

We do not pen these lines in order to save any weed of them all from destruction. The tares must be rooted out or what will become of the wheat? In fact, we are fully conscious that the very next time we see an impudent pig-weed overtopping our favorite marigolds, we will pluck it up root and branch. We merely desire to show that even the poor man may have his botanic garden; that in the words of Lowell:

> "A weed is nought but a flower in disguise,
> Which is seen through at once if love give a man eyes."

——:o:——

RECENT LITERATURE.

WALLACE'S TROPICAL NATURE.[1]—The gifted author's long residence in the tropical regions of the old and new world, and his large way of looking at nature, induced by extensive travel and acute observation in both hemispheres, have enabled him to produce a book, which, for the breadth of its views, and interest of its style, must claim a place among those few works in existence of which Humboldt's Views of Nature is a type. Wallace's general views, however, of tropical life and nature while fresh, and based on manifold and novel facts, will not perhaps be considered as particularly original to those who have read Humboldt's narratives and essays. Our author accounts for the great richness and variety of the plants and animals of the tropics by the uniformity of the equatorial climate in all parts of the globe. "Over a large portion of the tropics," he writes, "the same general features prevail, only modified by varying local conditions, whether we are at Singapore or Batavia, in the Moluccas, or New Guinea,

[1] *Tropical Nature and other Essays.* By ALFRED R. WALLACE. London, MacMillan & Co., 1878. 8vo. pp. 356.

at Para, at the sources of the Rio Negro or on the Upper Amazon, the equatorial climate is essentially the same, and we have no reason to believe that it materially differs in Guinea or the Congo." On the other hand the glacial period disturbed the uniformity of the temperate zone and caused a partial extinction of life. Where there are departures from the typical equatorial climate, as in rainless and desert tracts, this seems probably due to the nature of the soil or the artificial clearing away of the forests, and he cites the case of Central India where "the scanty and intermittent rainfall, with its fearful accompaniment of famine, is no doubt in great part due to the absence of a sufficient proportion of forest-covering to the earth's surface." He then calls attention to the fact that "with but few and unimportant exceptions a great forest band from a thousand to fifteen hundred miles in width girdles the earth at the equator, clothing hill, plain, and mountain with an evergreen mantle. Lofty peaks and precipitous ridges are sometimes bare, but often the woody covering continues to a height of eight or ten thousand feet, as in some of the volcanic mountains of Java, and on portions of the Eastern Andes." This forest belt merges into woody and then open country, soon changing into arid plains or even into deserts, where the great equatorial currents of air laden with moisture do not penetrate.

The primeval forests of the equatorial zone are distinguished from the forests of the temperate zones by their vastness, "and by the display of a force of development and vigor of growth rarely or never witnessed in temperate climates." There is also a great variety of specific forms, while the individuals are less numerous, this being the reverse of what is to be seen in the Temperate and Arctic Zones.

Animal life is likewise more abundant and varied specifically, many groups, as butterflies, parrots, humming birds, apes and monkeys, lizards, frogs and snakes being pre-eminently tropical, and in the tropics, "evolution has had a fair chance" while in the Temperate Zone, with its glacial periods, "it has had countless difficulties thrown in its way. The equatorial regions are then, as regards their past and present life history, a more ancient world than that represented by the Temperate Zones, a world in which the laws which have governed the progressive development of life have operated with comparatively little check for countless ages, and have resulted in those infinitely varied and beautiful forms—those wonderful eccentricities of structure, of function, and of instinct—that rich variety of color, and that nicely balanced harmony of relations, which delight and astonish us in the animal productions of all tropical countries."

While the chapters on tropical life occupy the first half of the book, the second half is devoted to essays on the color of animals and plants, and the origin of color-sense; on some relations

of living things to their environment; on the rise and progress of modern views as to the antiquity and origin of man, and on the distribution of animals as indicating geographical changes. These essays, though on recondite subjects, are of great general interest, and presented in the attractive style characteristic of the author's other popular works and essays.

BIBLIOGRAPHY OF NORTH AMERICAN INVERTEBRATE PALÆONTOLOGY.[1]—Works such as these, though laborious and requiring much time in their preparation, are naturally useful in proportion as they are full and accurate. The present work is probably as complete as others of the sort, the names of the compilers giving assurance that it is. In its scope the bibliography is confined to those works which treat, either wholly or in part, of invertebrate fossils found within the limits of North America, including the West Indies and Greenland, and, for convenience, the comparatively few contributions of American authors to the palæontology of other countries, and published in their own, have been included in Part I. Among the omissions that occur to us are papers and notes by Verrill and Scudder, Wood, and Packard on the Quarternary fossils of New England and Labrador, contributed to the Memoirs and Proceedings of the Boston Society of Natural History, and the Portland Society of Natural History, also Ordway's article on Paradoxides in the Proceedings of the Boston Society of Natural History.

PROCEEDINGS OF THE CENTRAL OHIO SCIENTIFIC ASSOCIATION.[2]—The members of this Association, which seems to have been quietly working for three years past, have done themselves no little credit by the publication of the first part of their Proceedings. The papers are mainly on archæological and historical subjects; among those on the former topics are two by Mr. T. F. Moses on the ancient remains of Mad River valley, with an account of the opening of the Baldwin and Roberts Mounds, and on the shell heaps of the coast of Maine. Mr. J. E. Warren contributes a report of a survey of earthworks on Haddix hill, Ohio, near Osborn, Ohio, and an account of a sculptured rock from Marblehead, Ohio. Rev. Geo. Gibson reports on the ancient pottery found near Green Bay, Wisconsin. The Society cannot do better than to continue to explore, and carefully map out all Indian mounds in the State, and figure the remains found in them. Such contributions are of lasting value.

[1] *Bibliography of North American Invertebrate Palæontology*, being a Report upon the Publications that have hitherto been made upon the Invertebrate Palæontology of North America, including the West Indies and Greenland. By C. A. WHITE, M.D., palæontologist of the U. S. Geological Survey, and H. ALLEYNE NICHOLSON, M.D., D. Sc., etc., Department of the Interior. U. S. Geological Survey of the Territories, F. V. HAYDEN, U. S. Geologist. Miscellaneous Publications, No. 10. Washington, 1878, 8vo, pp. 132.

[2] *Proceedings of the Central Ohio Scientific Association.* Urbana, Ohio, Vol. i, Part 1. Published by the Association, Urbana, 1878. 8vo, pp. 96, 16 plates.

WILSON'S PYCNOGONIDA OF NEW ENGLAND.[1]—This interesting group has at length received attention so far as the New England species are concerned, and is treated in such a manner that all the forms can be readily identified. Views of certain authors are adopted, for which no good morphological reasons are given, that these Arachnida have antennæ, the cheliceræ or mandibles being regarded as such. Both from embryological and morphological data, the arachnida in all their subdivisions seem to us to want these appendages, present in Myriopods and Hexapods. The systematic and artistic work seems to have been thoroughly well done. Appended is a table intended to show the general geographical and bathymetrical distribution of the species described in the present paper.

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[1] *A Synopsis of the Pycnogonida of New England.* By EDMUND B. WILSON. From the Transactions of the Connecticut Academy of Arts and Sciences, Vol. v, August, 1878. 8vo, pp. 26, 7 plates.

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GENERAL NOTES.

BOTANY.

New Classification of the Vegetable Kingdom.—At the close of his recent work, La Morfolojia Vegetale, Professor Caruel of Pisa proposes the classification of the vegetable kingdom into five primary groups as under, viz.:

1. *Phanerogamia.*—Every individual is trimorphic. The first form is neutral, and is capable of indefinite development, and of organic reproduction, principally by means of buds. The organic form gives rise, through the medium of the flower, to the two other sexual forms, male and female, which have only a definite development. The male form or pollen is thalloid; the female form or gemmule (ovule) is cormoid; this last produces first, a pro-embryo as the result of the fecundation, by the fovilla of the pollen, of an oösphere contained in a closed oögonium, and finally the embryo of the neutral form which develops at the extremity of the pro-embryo, and in the same direction. In the subdivision of Phanerogamia, Professor Caruel discards the distinction between Gymnospermia and Angiospermia, retaining as the two primary classes Monocotyledons and Dicotyledons, and giving the higher rank to the former.

2. *Schistogamia*, including *Characeæ* only. These are also trimorphic; but the male sexual form consists of vermiform phy-

tozoa (antherozoids) instead of pollen-grains, formed in an antheridium (antheridium), differing in structure from the anther; the female form consists of an oögemma (archegonium) comparable to a gemmule, but naked; the neutral form springs directly from the oösphere, which, on germinating, produces the embryo transversely.

3. *Prothallogamia* or Vascular Cryptogams.—These are also trimorphic. The neutral form does not produce the two sexual forms, but spores, these, on germinating, are transformed into sexual prothallia, with archegonic and naked oöspheres, and vermiform phytozoa contained in antheridia; the oöspore gives rise transversely to the embryo of the neutral form. The Prothallogamia are divided into *Heterosporæ* and *Isosporæ*.

4. *Bryogamia* (synonymous with *Muscineæ*).—The distinguishing character of this group is the indefinite power of development of the (female) sexual individual, together with the definite development of the neutral form or sporogonium. A consequence of this is the repeated and continued fecundation of which the female form is capable, which distinguishes the Bryogamia from the three preceding groups. The embryo springs directly from the oöspore; the male forms are phytozoa. The group is divided into *Musci* and *Hepaticæ*.

5. *Gymnogamia* (Thallophyta or Cellular Cryptogams).—The simplest Gymnogamia possesses only a single form which is reproduced organically by fission, by conidia and sporidia, or by gamogenesis, but without any sexual differentiation. In others there is sexual differentiation into male and female forms; a few have also a third neutral form, when the oöspore produces zoöspores, instead of passing directly into the female form. They resemble the *Bryogamia* in the definite development of the neutral form, and the indefinite development of the female form, but differ in the zoöspore-like form of the phytozoa, and in the structure of the oögonium, which is isolated and naked, and does not form parts of an archegonium. Professor Caruel altogether discards the old classification of Thallophytes into Algæ, Fungi, and Lichens, but does not propose any other in its place, and thinks it probable, that as our knowledge of some of its forms increases, it will be broken up into several primary groups. He considers it would be an advantage if the term Cryptogamia were altogether disused.—*Alfred W. Bennett.*

Rare Ferns in Central Florida.—On December 26, 1877, I met with *Blechnum serrulatum* Michx. in profusion at the northwest end of Santa Fe Lake, Florida. Subsequently I found it, equally abundant, on the opposite shore of the same lake. In both cases it grew in low hummock land, in the latter instance surrounded with magnificent specimens of the *Magnolia grandiflora* (trunks two feet in diameter), while in its neighborhood grew rather sparingly the rare and graceful *Polypodium plumula* H. B. K.

hitherto found, I believe, only at Tampa Bay. This additional station for the latter fern, so far in the interior, is of interest in its distribution. The former fern is recorded in Chapman's Flora as being found in Florida, on authority of Michaux and Buckley; while in William Edwards' Catalogue of North American Ferns, 1876, corrected by Professor D. C. Eaton, the habitat of "near Enterprise, Florida" (on the St. John's River) is given, so that I presume it is considered uncommon, if not rare.

I may also mention that I met with *Ophioglossum nudicaule* L. f. in an old field about one mile to the westward of Santa Fe Lake. I observed a habit in this diminutive fern (it is often barely one inch in height) which may not be generally known. I noticed that the spike or fertile part comes up wrapped in the winged petiole of the sterile part of the frond, and so remains, completely enclosed, till well advanced in its development.—*Henry Gillman, Waldo, Florida.*

Lycopodium cernuum in Florida.—In November, 1877, I found this rather elegant species growing in abundance on the sides of a damp, deep ditch, at Santa Fe Lake, Florida. It seemed quite at home, developing many protean forms and luxuriant vegetation. But it grew only where the clay had been exposed or thrown out in constructing the ditch, which is many years old. Dr. Chapman in his "Flora of the Southern United States," does not include *L. cernuum* L.; but I believe it is common in the tropics. I am not aware that it has hitherto been discovered within the United States. At any rate, it is interesting to find it so well established on these high lands in Central Florida. I also find frequent, in the low pine barrens in this same neighborhood, *L. inundatum* L. var. *pinnatum* Chapm., hitherto recorded as from "near the coast, West Florida."—*Henry Gillman, Waldo, Florida.*

Botanical News.—The *Bulletin* of the Torrey Botanical Club for July and August contains some rambling notes on collecting and preserving herbarium specimens which will be of value to young botanists. Professor Eaton records the discovery of a rare and curious moss, *Conomitrium julianum*, at Hamden, Connecticut. A farther note on the bibliography of North American lichenography by Mr. H. Willey, and a critical, lengthy notice of Rafinesque's monograph of Lechea, together with a notice by O. R. Willis of the occurrence of *Calluna vulgaris* at Egg Harbor, New Jersey, with references to other new New Jersey plants, complete the number.

The seventy-sixth fasciculus of the Flora Brasiliensis consists of the *Lemnaceæ* by Hegelmaier, and the *Araceæ* by Engler. The morphology and anatomy of the duck weeds, by the former author, is illustrated by a fine plate. The flowers and fruit of *Lemna* (Spirodela) *polyrhiza* are drawn from North American

specimens, as all those seen from Brazil are, like the British ones, barren. Messrs. Godwin and Salvin's forthcoming Biologia Centrali-Americana will contain a full catalogue of the known species of plants of Central America by Mr. Hemsley.

Pringsheim's Jahrbuch für Wissenschaftliche Botanik for 1878, contains a paper by Woronin on Plasmodiophora, the cause of "anbury" in turnips. R. Sadebeck writes on the development of the embryo of the horsetails (Equisetum) and H. Banke on the germination of the *Schizæaceæ*.

In the *Botanische Zeitung*, H. Nebelung continues his spectroscopic researches on the coloring matters of some fresh water *Algæ;* A. DeBary discourses on a apogamous ferns, and the phenomena of apogamy, in general.

The French Academy has elected as corresponding members of the section of Botany, Dr. Asa Gray and Mr. Charles Darwin.

ZOÖLOGY.[1]

The Right Whale of the Southern European Seas.—Prof. Gasco, of Genoa, has recently published, through the Royal Academy of Sciences of Naples, a full description of the external and internal characters of a right whale which was taken near Taranto, in 1877. This specimen was regarded by Dr. Capellini as representing a species new to science, which he named *Balæna tarentina*. Prof. Gasco has concluded on the other hand that it is a specimen of the *B. cisarctica* Cope, thus confirming the supposition of Prof. Cope that the species of the eastern coast of North America is identical with that of the Gulf of Biscay. The specimen is not adult, and of about the same age and size as the one captured near Philadelphia about 1864.

M. Fischer, of Paris, after a study of the remains and descriptions of the whales of the Temperate and Southern European coasts within his reach, has found the following to be related forms: The *Balæna cisarctica* Cope, and the Saw of the American coast; the Nordkaper and *Balæna biscayensis* of the European coast; the *Hunterius temminckii* Gray, of the Cape of Good Hope, and the subfossil *Hunterius swedenborgii* Lillj., of Gothland and *Balæna lamanoni* of Paris. He concludes that these are not all identical, but belong to two divisions, perhaps of one species each, which are characterized, the one by the very small head, bifid first rib, and the very thick and almost cylindrical inferior extremities of the ribs; the second by a larger head, simple first and flattened following ribs. To the former belong the *Hunterii* and the *B. biscayensis*; to the latter the *A. cisarctica* and the Saw.

A new species of Gorilla.—An adult female of a species of Gorilla was received in Paris about a year ago, and became the

[1] The departments of Ornithology and Mammalogy are conducted by Dr. Elliott Coues, U. S. A.

subject of a comparative study by MM. Alix and Bouvier. These naturalists became convinced that the animal belongs to a species distinct from the *G. savagei*, which they named in a communication to the Academy of Sciences, *G. mayema*. Its principal characters are seen in the spines of the anterior cervical vertebra, which are much less elevated than in *G. savagei*, and in the greater approximation of the orbits, and prominent acute ridge of the middle line of the interorbital region. The species is smaller than the gorilla, about equaling the chimpanzee. Various other characters are mentioned by MM. Alix and Bouvier, the value of which is as yet uncertain. The cranial crests are highly developed. The typical specimen was obtained on the coast of Quilo in Congo.

The Herpetology of New Guinea.—Dr. H. E. Sauvage has recently given in Bulletin of the Société Philomathique of Paris, a list of the reptiles of New Guinea known up to the present time. He enumerates of *Testudinata*, 3 species; of *Lacertilia*, 46 species, divided among the families as follows: *Gecconidæ*, 12; *Agamidæ*, 6; *Varanidæ*, 5; *Scincidæ*, 23. Of *Ophidia* there are 34 species, divided as follows: *Scolecophidia*, 2; *Peropoda*, 6; *Colubroidea*, 17; *Proteroglypha*, 9. The most noteworthy facts are: First, the absence of Solenoglyph serpents, as in Australia (See Proceedings Academy Nat. Sciences, Philadelphia, 1859, on *Acanthophis*). Second, the genera *Erebophis* and *Chondropython*, the latter resembling some of the *Boidæ* in several respects. Third, the large number of *Scincidæ*, and (4) *Gecconidæ;* (5) the presence of *Platemys* as in Australia.—*E. D. Cope.*

A Monstrous Frog.—Mr. Jacob Stauffer, the veteran naturalist of Lancaster, Pa., sends me a drawing of a frog (*Rana palustris*) with a well developed extra hind limb or what appears from his drawing and description to be, speaking more correctly, a united pair of hind limbs, though occupying an asymmetrical position, and having their true homologies to a certain extent concealed from this cause. A sketch and remark of Mr. Stauffer's, however, show the true nature of this limb to be compound, that is, that it consists of two united halves derived by development from both sides of the body. He remarks: "The extra leg is of the same color above and below, whilst the other or normal legs are of a dirty yellowish color beneath." He further says this leg has six instead of five toes, and gives a sketch which leads me to think that the digital formula of the compound foot must be written in this manner: 5, 4, 3, 3, 4, 5, showing clearly that the limbs are fused together by their inner faces, thus bringing the outer or fourth and fifth toes to the outside, whilst the prevalence of the superior and outer dark colors, and concealment of the inner and inferior yellow tints, is just what ought to happen in the event of such union.

Altogether it is a very interesting case of the development of additional limbs, and is probably of commoner occurrence than is generally supposed. Its origin is probably to be attributed to injury or shocks, the same as that of monsters in general, as has been shown by direct experiment on eggs, and as I have been led to believe from the numerous cases where additional tails or branches arise from the original organs of lizards when broken off or injured. It may be the working of some atavismic tendency, where the organism is making an effort to return to some remote ancestral form, an explanation which will not answer, however, with respect to the lizard's tail. The theory of the archipterygium may explain it.—*Jno. A. Ryder.*

THE COCOONS OF MICROGASTER.—In examining the Microgaster which infests the different species of Macrosila, I have noticed several points in the spinning of the cocoon which are different from what are described in the very interesting note in the August number of the NATURALIST.

Never having studied those which are found upon the Philampelus, I do not know to what extent, if any, the parasites of the potato worm differ from them in structure.

First, as the worm issues from the body of its host, it does not assume the erect position even for a moment, but remains flexed, with its head ready to begin spinning as soon as the last segments of the body appear. There is, apparently, no envelope to the body, and the first active movements are those of the head as it fixes the preliminary stay threads previous to spinning in the regular loop form. This goes on precisely as described in the note referred to until the worm has finished one side, has turned upside down and is ready to complete the other half of its case. Then, instead of beginning to spin at the bottom, it quickly flexes its body, thus bringing its head back to the "toe of the slipper," from which it spins downward till the back of its host is reached and it is entirely enclosed.

The spinning of the two sides of the cocoon, then, is practically upon the same plan. In the first half the straightening of the bent body proceeds from below upwards, in the second, from above downwards. The position of the extremities is, of course, reversed in the two instances. The second position, though apparently a difficult one to assume, is nevertheless easily taken by the worm, no matter what may be its position upon the body of its host. The time required for completing this envelope is from thirty to forty-five minutes. In the further lining and completing the cocoon the worm can be seen to turn about four times before the structure becomes opaque.—*Wm. A. Buckhout.*

CETONIA INDA INJURING CORN.—This common and generally harmless beetle is reported by Mr. C. B. Smith, of Granby, Mass., to be injurious to corn. He sends us a specimen which he says,

" was found under the husk of an ear of corn. I found twenty about one ear, and have seen them about corn in several places in this garden. Several were found with their heads buried to the bottom of a kernel of corn, and bodies standing out from the ear. I think it is the same insect as is found in Pittsfield, South Hadley, Newton, Conway and other places, and called the 'corn bug' in our papers."

ANTHROPOLOGY.[1]

CRANIA UTILIZED AS CINERARY URNS IN A BURIAL MOUND IN FLORIDA.—In opening a burial mound at Cade's Pond, a small body of water situated about two miles northeastward of Santa Fe Lake, Florida, the writer found two instances of cremation, in each of which the skull of the subject, which was unconsumed, was used as the depository of his ashes. The mound contained besides a large number of human burials, the bones being much decayed. With them were deposited a great number of vessels of pottery, many of which are painted in brilliant colors, chiefly red, yellow and brown, and some of them ornamented with indented patterns, displaying not a little skill in the ceramic art, though they are reduced to fragments. The first of the skulls referred to was exhumed at a depth of two and a half feet. It rested on its apex (base uppermost), and was filled with fragments of half-incinerated human bones mingled with dark-colored dust, and the sand which invariably sifts into crania under such circumstances. Immediately beneath the skull lay the greater part of a human tibia presenting the peculiar compression known as platycnemism to the degree of affording a latitudinal index of .512; while beneath and surrounding it lay the fragments of a large number of other human bones, probably constituting an entire individual.

In the second instance of this peculiar mode in cremation, the cranium was discovered on nearly the opposite side of the mound, at a depth of two feet, and, like the former, resting on its apex. It was filled with a black mass—the *residuum* of burnt human bones mingled with sand. At three feet to the eastward lay the shaft of a flattened tibia which presents the latitudinal index of .527. Both the skulls were free from all action of fire, and though subsequently crumbling to pieces on their removal, the writer had opportunity to observe their strong resemblance to the small orthocephalic crania which he had exhumed from mounds in Michigan The same resemblance was perceptible in the other crania belonging to this mound. The small, narrow, retreating frontal, prominent parietal protuberances, rather protuberant occipital, which was not in the least compressed, the well-defined supraciliary ridges, and the superior border of the orbits presenting a quadrilateral outline, were all particularly noticed. The lower facial bones including the maxillaries were wanting.

[1] Edited by Prof. OTIS T. MASON, Columbian College, Washington, D. C.

On consulting such works as are accessible to him, the writer finds no mention of any similar relics having been discovered in mounds in Florida or elsewhere. For further particulars reference may be had to a paper on the subject read before the St. Louis meeting of the American Association, August, 1878.—*Henry Gillman, Waldo, Florida.*

ANTHROPOLOGICAL NEWS.—The eleventh annual report of the Peabody Museum of American Archæology and Ethnology is the most important contribution to anthropology that has appeared during the year, either in this country or in Europe. The Trustees having completed the new building for the museum, the inaugural exercises are fully reported in the volume. The titles of the scientific papers are: Second Report of the Implements found in the Glacial Drift of New Jersey, by C. C. Abbott; The Method of Manufacture of Several Articles by the former Indians of Southern California, by Paul Schumacher; Cave Dwellings in Utah, by Edward Palmer; The Manufacture of Soapstone Pots by the Indians of New England, by F. W. Putnam; Notes on a Collection from an Ancient Cemetery in Southern Peru, by John H. Blake; Archæological Explorations in Tennessee, by F. W. Putnam; Observations on the Crania from the Stone Graves in Tennessee, by Lucien Carr; On the Tenure of Land among the Ancient Mexicans, by Ad. F. Bandelier. The paper of Mr. Abbott is a continuation of the one contributed to Vol. X upon the evidences of the pre-glacial, or intraglacial existence of man in New Jersey. Whatever may be the true interpretation of the facts set forth by Mr. Abbott, we are confident that the day has gone by when evidence of this kind will not receive a patient and unprejudiced hearing. Two separate questions spring out of these researches, viz.: whether the implements are of human manufacture, and whether the beds in which they lie are related to the so-called Glacial Age. The explorations of Mr. Putnam, in Tennessee, were crowned with signal success, and the construction of the mounds and graves, together with the contents human and depository, have enabled him to classify the people who constructed them and lie buried in them. The supplementary article by Mr. Carr upon the crania adds greatly to the value of Mr. Putnam's paper. The contribution of Mr. Bandelier is supplementary to his paper on the Art and Mode of Warfare of the Ancient Mexicans in Report X. The author belongs to the Morgan school of critics, holding that the descriptions of the chroniclers of the sixteenth century interpreted savage society in the light and language of their own countries. The author exceeds Mr. Morgan in the justice of his appreciation of the motives of the old authorities. His command of authorities is immense; but his use of them is often painful to the reader, as for instance his reference to Sr. Icazbalceta's "Col. de Documentos," and other rare and precious works,

the only copies of which in the United States perhaps are in the private library of Mr. Bandelier. The conclusions of the paper are:

1. The notion of abstract ownership of the soil, either by a nation or State, or by the head of its government, or by individuals, was unknown to the ancient Mexicans.

2. Definite possessory rights was vested in the kinships composing the tribe; but the idea of sale, barter, or conveyance or alienation of such by the kin had not been conceived.

3. Individuals, whatever might be their position or office, without any exception, held but the right to use certain defined lots for their sustenance, which right, although hereditary in the male line, was nevertheless limited to the conditions of residence within the area held by the kin, and of cultivation either by or in the name of him to whom the said lots were assigned.

4. No possessory rights to land were attached to any office or chieftaincy. As members of a kin, each chief had the use of a certain lot, which he could rent or farm to others, for his benefit.

5. For the requirements of tribal business and of the governmental features of the kinship (public hospitality included) certain tracts were set apart as official lands, out of which the official households were supplied and sustained; but these lands and their products were totally independent from the persons or families of the chiefs themselves.

6. Conquest of any tribe by the Mexicans was not followed by annexation of that tribe's territory, nor by an apportionment of its soil among the conquerors. Tribute was enacted, and for the purpose of raising that tribute (in part) special tracts were set off, the crops of which were gathered for the storehouses of Mexico.

7. Consequently, as our previous investigation (of the warlike institutions and customs of the ancient Mexicans) have disproved the generally received notion of a military despotism prevailing among them, so the results of this review of tenure and distribution of lands tended to establish, "that the principle and institution of feudality did not exist in aboriginal Mexico."

In *Nature*, for August 22d, is a review, by Mr. W. B. Dawkins, of a work entitled, "British Barrows; a record of the examination of Sepulchral Mounds in various parts of England, by William Greenwell, M.A., F.S.A., together with Description of Figures of Skulls, General Remarks, Prehistoric Crania and an Appendix. By George Rolleston, M.D., F.R.S. The observations of Mr. Dawkins are so practical, and the results resemble so nearly many of our own remains that we give a lengthy extract from his review:

"The barrows vary in size and shape very much as the graves and tombs in our own graveyards, where the rich man's memory is preserved by the large mausoleum, while the poor man's resting place is marked merely by the little mound of earth, soon to be lost in the general surface. Those in the Yorkshire wolds are

either circular or 'long,' the former being the more abundant, and are frequently surrounded by a *ramp* or a ditch. In some cases this was within the base of the barrow, and very generally it was incomplete. 'This very remarkable feature,' writes Mr. Greenwell, 'in connection with the inclosing circles, is also found to occur in the case of other remains which belong to the same period and people as the barrow. The sculptured markings engraved upon rocks, and also upon stones forming the covers of urns or cists, consist in the main of two types, cup-shaped hollows and circles, more or less in number, surrounding in most cases a central cup. In almost every instance the circle is imperfect, its continuity being sometimes broken by a duct leading out from the central cup; at other times by the hollowed line of the circle stopping short when about to join at each end. The connection of the sculptured stones, if so they may be termed, with places of sepulture brings them at once into close relationship with the inclosing circles of barrows, and it is scarcely possible to imagine but that the same idea, whatever that may have been, is signified by the incomplete circle in both cases. The rings of gold and bronze, of various shapes, some of which in their construction show that the penannular form is not caused by the requirements of their use, appear to represent the same incomplete circle. In fact, if some of the gold rings were figured upon stone they would appear in the very similitude of the circular rock sculptures.' Our author suggests that it may have been intended to prevent the exit of the spirits of those buried, though in that case it is hard to see why the spirit should not have found its way out through the opening. It seems more probable that if the barrow represented the hut inhabited by the living that the circle round it would represent the trench, or the inclosure of the hut, and that this would necessarily be incomplete to allow of access to the habitation. The dead were buried in the barrows of the wolds, very generally in the condition and clothing in which they died, the proportion of cases of inhumation to those of cremation being as 301 to 378, or about 80 per cent. In all probability both customs were carried on simultaneously, as was the case in ancient Rome, where, however, inhumation was mainly confined to the lower classes. Where inhumation had been practiced the body was buried in the crouching position in which life had departed, and which would be natural where the sleeping place was not well protected against the cold, and the covering was scanty. This interpretation, due to the ingenuity of Mr. Evans, is most likely true. The burnt and broken bones of various animals used for food, in the barrow, are probably the remains of funeral feasts, held at the time of the interment, or from time to time afterwards, or they may be the remains of food offered to the dead. Splinters and various manufactured implements of flint and fragments of pottery also occur sometimes in

great abundance, and probably symbolize some religious idea. Fragments of flint were used in interment at least as late as the fourth and fifth century after Christ in this country; for they were found in considerable quantities inside the oaken coffins in the Romano-British cemetery, referable to the above date, explored at Hardham, Sussex, in 1866. Where cremation was practiced, the funeral pile was sometimes kindled upon the spot, which was afterwards occupied by the barrow, but at other times the ashes of the dead were collected and deposited somewhere else. In several barrows curious perforated vessels of pottery, or 'incense cups' were met with, which may have been used to convey the sacred fire to the pile. The ashes of the dead were placed in urns sometimes highly ornamented, and those things which delighted the dead most, or were most useful to him, were deposited in the tomb. Flint scrapers, flakes, arrow-heads, beads, hammer axes, celts, domestic pottery and a few bronze articles. The number of objects buried in each barrow varied according to the wealth of the dead and the estimation in which he was held by the survivors.

"The animal remains in these barrows proved that the ancient inhabitants of the wolds were no rude savages, living mainly on the chase. They possessed flocks and herds, consisting of well known domestic breeds—the small Celtic short-horn, now represented by the mountain cattle of Wales and Scotland, the pig, the horned sheep or goat, the horse and the dog, the two last being the rarest. They also ate venison of the stag (*Cervus elaphus*). Their place in the archæological scale of culture is fixed by the few and simple forms of bronze articles in the barrows. The simple wedge-shaped axe and the short, broad dagger, in association with various articles of stone, coupled with the absence of the higher bronze types, such as the sword. They belonged to the early bronze age. The absence of the sword is also noticed in the tumuli of France, referred by M. Chantre to the same horizon. At this time the knowledge of bronze was gradually finding its way northwards from the Mediterranean centres, and the simpler forms preceded the more complex and elaborate.

"Nor are we left in doubt as to the ethnical relations of these ancient Yorkshiremen. Prof. Rolleston's elaborate examination of the crania and skeletons reveals the fact that two types, the small long-headed "Iberian" and the tall, robust round-heads, or "Celtic," which have been traced by Thurman, Huxley, Busk and myself, from Scotland to the Mediterranean, and from the Rhine to the Pillars of Hercules, occur in the round barrows side by side in intimate association. The former of these 'the Silurians' of Prof. Rolleston, is considered in this work as the older of the two. According to Dr. Thurman it was dormant in Britain in the neolithic age, at the close of which it was invaded by the

"Celtic" or "Cimbric" of Prof. Rollesten. The truth of this view is confirmed by the fact that the dead of these two races rest peacefully together in the round barrows of the wolds referable to the early bronze age.

"In concluding this review it remains merely to say that this valuable work fills a void in the archæological record of Great Britain, and it contains a larger mass of accurately observed facts than any book hitherto published relating to the bronze age in this country."

Rev. Stephen Bowers, Ph.D., is continuing his explorations in Southern California this summer, with head-quarters at Santa Barbara. His researches fully sustain Mr. Stephen Powers' estimate of the vast number of aborigines once inhabiting the Pacific coast. Between Point Rincon and Point Conception, a distance of seventy miles along the coast, Mr. Bowers has explored nearly seventy (70) Pueblos or sites of old Indian towns, and about thirty on the Santa Iñez river. In one burial place on this river he obtained 240 fine specimens consisting of mortars and pestles of sand-stone; bowls, pipes and "charms" of serpentine; ollas and tortilla stones of crystallized talc; spear-points and arrow-heads manufactured from chert, etc., etc. Besides these specimens he obtained nearly half a bushel of beads and ornaments from stone, bone and shells. Near Guadaloupe Mr. Bowers obtained from a single pueblo over 1800 specimens in stone. These consisted of bowls and pestles from granite, sandstone and serpentine; mano stones used in grinding; balls, knives, drills, tools, spear-points, arrow-heads, scrapers, etc., from chert; sinkers finely wrought from serpentine and talc, etc., etc. Dr. Bowers and his wife discovered these antiquities on the mainland nearly four years ago, since which they have shipped several tons of fine specimens to enrich the National Museum. Mrs. Bowers accompanies her husband in all his researches, and is herself an indefatigable collector.

Attention is called to the following titles: Folk-lore on Wells and Water, A. Fraser, *Celtic Magazine*, August 8; Japanese Mythology and Religious Worship of the Ancients, *Westminster Review*, July; Mound Builders, were they Egyptians, and did they occupy the State of New York, *Mag. of Am. Hist.*, September; Palæographie Américaine. Dichiffrement de l'Ecriture Maya, H. de Charency, *Annales Philosophie Chiétienne*, July 14; A Comparison of the Pueblo Pottery with Egyptian and Grecian Ceramics, A. S. Barber, *American Antiquarian*, I, 2, July; Brewing in Japan, *Nature*, September 12th.

FOREIGN.—The Anthropological Institute of Great Britain and Ireland has lately devoted a whole session to the discussion of the antiquity of man. Professor Boyd Dawkins read on this occasion a long paper on the caves of Great Britain, among which he selected those of Cresswell as typical examples. In these caves, Robin

Hood's and Church Hole, palæolithic utensils have been found in corresponding situations. The bottom of the caves is covered with a layer of light-colored sand, doubtless the result of the decomposition of the rock. Next follows a stratum of red sand and clay of about three feet thickness, containing fragments of stones and bones of extinct animals, usually broken and gnawed by hyenas which had brought them to their dens. The sand and the clay bear witness to inundations which reached a height of at least twenty feet above the present water-level. The osseous remains belong to the following species: Lion, spotted hyena, fox, wolf, bear, reindeer, Irish stag, aurochs, horse, rhinoceros, mammoth, and hare. The presence of man is revealed by some rudely worked quartzite flakes, which suffice to demonstrate that savages of a very low order contended from time to time for the possession of the caves with hyenas, which came back again when the human occupants had left. The association of these heterogeneous *débris* in this deposit is thus accounted for. It was covered by a stratum of red, loamy earth, the upper portion of which passed over into a calcareous breccia. Here numerous fragments of bones, either gnawed by hyenas, or broken and scratched by man, was intermingled with charcoal and calcined bones, and with implements of quartzite and flint representing forms known in Great Britain and on the Continent. Some were identical with those found in the gravel-beds of Brandon, Bedford and Hoxne, and of Saint-Acheul and Toulouse. All these occur associated with the remains of the mammoth, the reindeer and rhinoceros. The layer enclosed flakes, blades, scrapers, perforators and spear-heads resembling those of Solutré. There were also awls and needles of bone, and with the worked bones was found a rounded and polished piece of a rib on which an outline drawing of a horse is traced. This specimen reminds one of similar discoveries in French and Swiss caves. The fauna comprises the following species: Machairodus, lion, wild-cat, leopard, spotted hyena, fox, wolf, bear, reindeer, Irish stag, aurochs, horse, rhinoceros, mammoth and hare. A crust of stalagmite, about a foot in thickness, rested upon this layer. The distribution of the objects found in the Creswell caves points to three successive periods of human occupancy. The red sand contained a few rude implements of quartzite. In the lower deposit of the red loamy earth the chipped objects consisted of quartzite and flint, the latter occurring not nearer than forty miles from this locality. In the upper part of the same layer quartzite disappears almost entirely, and is replaced by numerous flint implements. Here was also found the engraving of a horse, and by far the greater number of bone tools. Such a successive series, Professor Dawkins thinks, has not yet been met with either in England or on the Continent. It shows a marked progress in the mechanical arts of the cave-dwellers, while the fauna has remained unchanged.

Professor Dawkins drew particular attention to the promiscuous character of the bones found in palæolithic cave-deposits. These bones belong to extinct or still living northern and tropical animals, and to such as pertain by their nature to moderate climates. In explanation of this fact he says: "There existed in those times a vast continent contiguous to Africa, and stretching as far as the extreme limits of Ireland and Scotland. In summer the lion, sabre-toothed tiger, spotted hyena and hippopotamus went northward, while during winter the reindeer, musk-ox, lemming, tailless hare, glutton and Arctic fox sought refuge in the South." The mixed bones of these animals, he states, show no difference in their chemical composition, which certainly would not be the case if long periods had intervened between the time of their existence. The views of Mr. James Geikie, as given in his "Great Ice Age," were strongly opposed by the lecturer. The May number of the *Matériaux pour L'Histoire Primitive et Naturelle de L'Homme* contains a long and highly illustrated review of the splendid work by Mr. Ernest Chantre, relating to the Bronze Age of the Rhône district. A copy of the large map accompanying that work is presented to the readers of the *Matériaux*. This map embraces France and the adjacent parts of Germany and Switzerland. All points of archæological interest, such as caves, palafittes, tumuli, dolmens, etc., are indicated on it by different signs, denoting by their colors the probable age to which each locality pertains.

The Proceedings of the Berlin Anthropological Society for 1877 (*Verhandlungen der Berliner Anthropologischen Gesellschaft*) were lately received. On the 7th of April the Anthropological Society, in conjunction with the Geographical Society of the same city, gave a reception to the Emperor of Brazil. On this occasion Professor Virchow delivered a long and interesting address on the anthropology of America. A translation into English would be very desirable.

GEOLOGY AND PALÆONTOLOGY.

The Reptiles of the Upper Jurassic of the North of France.—Dr. H. E. Sauvage has described in the *Bulletin* of the Geological Society of France a description of some bones of the limbs of a Sauropterygian reptile, which he refers to the genus *Polycotylus*, under the name of *P. suprajurensis*. A Dinosaurian of the same horizon he refers to the genus *Iguanodon*, under the name of *I. precursor*. Dr. Sauvage adds to the list the previously known species, *Megalosaurus insignis* Desl., *Omosaurus armatus* Ow., and *Bothriospondylus suffossus* Ow., all *Dinosauria*. He obtains *Megalosaurus*-like teeth from the Gault of the Meuse and of Ardennes.

A Quaternary Camel from Roumania.—Professor Stephanesco, of Belgrade, recently communicated to the Geological

Society of France a specimen of an almost entire lower jaw of an extinct species of camel found in a quaternary deposit in Roumania. Remains of probably the same species have been found in Hungary. It belongs to the genus *Pliauchenia* (Cope), a form hitherto only known as American, which is intermediate between the genus *Camelus* and the *Procamelus* of Leidy. The species was rather smaller than the *Camelus dromedarius*.

The Fauna of the Lowest Tertiary of France.—Below the lignite and argile plastique of Meudon, where the greater number of types of the Suessonien Fauna have been discovered, several horizons of the Lower Eocene are recognized in France. Immediately below the argile plastique is the conglomerate of Meudon and Cerny, and, still lower, the Sables de Bracheux. The latter is the first horizon above the upper bed of cretaceous, or the Pisolitique, which is perhaps to be parallelized with the Mæstrichtien.

Dr. Lemoine has recently investigated the vertebrate fauna of these beds with much success. I give a brief notice of his discoveries, which are of much interest to American palæontologists, in view of the light they throw on the faunæ of the corresponding periods of the history of our continent.

In the Sables de Bracheux he finds peculiar Squalodonts, and a new species of the genus *Myledaphus*, thus far only known from the Laramie bed of the Judith river of Montana. Also a *Chimæra* like the *Mylognathus* of Leidy; a gar of the genus *Clastes* Cope, which is shown to be quite distinct from *Lepidosteus* in the entire maxillary bones, and Lacertilia.

In the conglomerate, Dr. Lemoine finds *Mammalia* related to *Adapis*, viz: *Lophiochœrus copei* Lem., and two species of *Plesiadapis* Gerv.; also two species of *Arctocyon* and a new genus, *Pleuraspidotherium*. With these occur in abundance, the remains of the genus *Champsosaurus* (Cope *Simœdosaurus* Gerv.) *lemoinei* Gerv, which is well known as characteristic of the American Laramie group. Crocodiles and alligators are abundant, with turtles of the genus *Compsemys* Leidy. There are numerous squalodonts, and a large species of *Pappichthys* Cope, a genus of *Amiidæ* which first appears in America in the Bridger formation.

The greatest number of species were found by Dr. Lemoine in the Sables and other beds of the horizon of the Lignite of Meudon, or nearly that of the *Gastornis*, the *Palæonyctis*, and the *Coryphodon eocœnus*. The following names of genera of mammalia recall the Wasatch and Bridger fauna of America. *Phenacodus*, *Hyracotherium*, *Opisthotomus*, *? Hyopsodus*, *? Stypolophus*, *Miacis*, and the *Lophiochœrus peroni* and three species of *Plesiadapis* Gerv., *Orotherium* (Cope), *Pachynolophus*, *Lophiodon* and one or two Artiodactyles. Crocodiles, *Ophidia* and *Lacertilia* are more abundant, with birds and turtles. The genera of the latter are very familiar on this side of the Atlantic; *Polythorax* Cope, a *Dermate-*

mys near *costilatus; Anostira* Leidy, *Trionyx;* a form much like *Plastomenus lachrymans* and a genus near to *Compsemys* Leidy, perhaps the *Apholidemys* of Pomel. Of fishes, *Pappichthys* is abundant, mingled with the marine genera *Myliobates*, *Phyllodes* and Squalodonts.

The above lists present a mixture of the Laramie, Wasatch and Bridger fauna of Western America. It is remarkable that of the first named, only those of Tertiary character have been found by Dr. Lemoine, since the numerous types of *Dinosauria*, are entirely wanting.—*E. D. Cope.*

GEOGRAPHY AND TRAVELS.[1]

Lake Nyassa.—Mr. H. B. Cotterill has recently returned to England, after an absence of nearly two years, during which he explored the Nyassa lake and also made the journey from its northern end to Dar-es-Salaam (on the coast twenty-five miles south of Zanzibar), a distance of 350 miles, passing through a region never before visited by Europeans.

From a paper read before the Royal Geographical Society, on the 25th of March, and a lecture delivered at the Society of Arts, on May 27th, and reported in the *Times*, we learn that the principal object of his journey was to endeavor to plant in Central Africa, a germ of legitimate commerce and thus assist in the destruction of the slave trade. Mr. Cotterill sketched the suppression of this traffic on the coast line, and stated that the word "suppression" exactly expressed the circumstances of the case. This trade is now scotched but by no means dead. Were the pressure put upon the trade now relaxed, slavery would again revive. Footholds and centres for civilizing influences in the interior must be secured before it can receive its death-blow. The advantages which the Nyassa offered for commencing beneficial influences upon the interior were, that there existed a great lake settlement; the accessibility of the Nyassa both by land and water, as compared with other lakes; the magnificent water-way supplied by the Nyassa, itself, to the very heart of the continent, and the commanding position that any settlement at the north end of the Nyassa would hold. He found the northern portions of the lake far more beautiful and populous than the granite country of the south. Ivory is in abundance. There was evidence of the presence of precious metals. Cotton grew wild and was also cultivated by the natives. Sugar cane, grains of various kinds, yams, bananas and the like grew luxuriantly. The region was as healthy as India when once a person had become acclimatized.

His journey to the coast was made in company with Capt. Elton, late British Consul at Mozambique, and three friends. From the northern end of the lake a flat marshy country extends towards the southern end of Tanganyika which was said to be

[1] Edited by Ellis H. Yarnall, Philadelphia.

about ten or twelve days distant. After a few days march they reached a great plain bounded by a range of mountains called Kondi, running from the eastern side of the lake to the northwest. Several rivers intersect the plain running towards the Nyassa and it is a country of remarkable beauty and fertility. By a gradual ascent the height of 6000 feet above the sea was reached. Finally, passing through forests of gigantic bamboos, they crossed the Kondi range at a height of 8800 feet above the sea, and found themselves on a great plateau 7000 feet high called Uwanji, a splendid cattle country. Here they soon came to Merere's town. From this point other plains intersected by many streams could be seen. They suffered much during the remainder of the journey from scarcity of food and shortly before reaching the Ujiji caravan route, 350 miles from Bagamoyo, Captain Elton, who had been failing rapidly, died.

The rest of the party arrived safely at Zanzibar, after a journey of four months and a half from Livingstonia. A full account of the journey, under the title "Researches and Adventures among the Lakes and Mountains of Eastern Africa," will soon be published.

A direct road from Dar-es-Salaam to the lake has already been begun at the expense of one or two private persons. The Royal Geographical Society has decided to dispatch a carefully-organized expedition commanded by Mr. Keith Johnston to explore this region, and contemplates pushing their explorations to the southern end of Lake Tanganyika, a further distance of 190 miles. The expedition is expected to leave England early in November. Some weeks will be spent in scientific investigation in the coast regions near Zanzibar. A geologist has been appointed as assistant and second in command to Mr. Johnston. The route to Livingstonia, the Scotch Mission settlement at the southern end of Nyassa, is being improved by the opening of the rivers Zambesi and Shire by the Portuguese to steam navigation, and the making of a road for seventy miles around the rapids of the Shire to a point whence the steamer *Ilala* runs to the new colony.

In connection with the remarks of Mr. Cotterill it may be stated that the transport of slaves by sea is being rapidly crushed out by the exertions of the British fleet engaged in that service on the east coast of Africa. During the last half of 1877 only nineteen slaves were captured, while in the previous six months the number was 263. Two years ago the computed average of slaves introduced into Pemba amounted to 1000 a month, but not more than 800 are believed to have been landed during the last six months of 1877. The caravans sent down to the coast are very small; many were captured and others returned to the interior, no market being found for them.

A meeting of geographers and telegraph engineers was

recently held in London to consider the connection of the Egyptian telegraph lines now reaching Khartum with those existing at Kimberley in the extreme south of Africa. The Central African Telegraph Company are already making arrangements to run a line from the Transvaal to Zanzibar.

OBITUARY.—Dr. August Heinrich Petermann died at Gotha, on the 26th of September. This very eminent geographer was born at Bleicherode, a village of Prussian Saxony, April 18, 1822. Educated at the Potsdam Geographical Institute, founded by Berghaus, the well known author of the "Physical Atlas," he afterwards became his secretary and assistant in preparing the maps for his great work, and also for that of Alexander von Humboldt on Central Asia. Removing to Edinburgh in 1845, and afterwards to London, he aided largely in the bringing out of Dr. A. K. Johnston's "Physical Atlas" and other geographical works, took an active part in the proceedings of the Royal Geographical Society, and was instrumental in sending Drs. Barth, Overweg and Vogel to Central Africa. In 1854, he undertook the charge of the great geographical establishment of *Justus Perthes*, at Gotha, where he remained until his death, founding and conducting with great success the *Mittheilungen aus Justus Perthes' Geographischer Anstalt über Wichtige neue Erforschungen auf dem Gesammtgebiete der Geographie*, a monthly periodical whose volumes constitute an almost complete record of the progress of geographical discovery since that date, illustrated by a vast number of maps and plans. The first and second North German Expeditions to the North Pole were sent out under his direction and material support. The new edition of Stieler's "Hand-Atlas" (1875), contains many maps drawn by him, including the best, for their size, that have yet appeared of the western portion of the United States. The loss, at a comparatively early age, of one whose untiring industry and enthusiastic devotion has so greatly aided in extending the bounds of civilization, is deeply deplored.

MICROSCOPY.[1]

NATIONAL MICROSCOPICAL CONGRESS (*Continued*).—"The Migration of Leucocytes," by Dr. W. T. Belfield, of Chicago. In examining microscopic sections of the kidneys of persons who had died of pneumonia, the author had found the intertubular tissue crowded with an abundance of cells having all the appearance of white blood corpuscles. As other appearances of renal inflammation were wanting, and there had been no previous history of renal disease, it was judged that the retardation of the blood current incident to the pneumonia had furnished the occasion for the escape, from the capillaries, of the blood corpuscles by means of their amœboid movements. To test and study this fact of migration of leuco-

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

cytes in passive hyperæmia, frogs were curarized, the femoral vein exposed by dissection, and pressure applied by means of an India rubber band and a plug of cork. The web of the corresponding foot was stretched upon the stage of the microscope, and the pressure upon the vein regulated so as to retard the current of blood without producing complete stagnation. That the effects produced were due to passive and not to active hyperæmia, to mechanical congestion and not to inflammation, is shown by the absence of other phenomena of inflammation, and by the fact that discontinuance of the pressure on the vein was immediately followed by full restoration of the circulation. In one instance, migration was observed within three hours after compression was made, but in others no migration was detected within the first nine hours. Sooner or later, in all cases, leucocytes were seen to leave the vessels in considerable numbers, not usually from the minutest capillaries but from the large capillaries and small veins of from $\frac{1}{1500}$ to $\frac{1}{1600}$ of an inch in diameter. Emigration also occurred where the currents were rapid and sparsely supplied with corpuscles, as well as from slow currents crowded with corpuscles. The time of exit averaged from one to two hours, but was sometimes as short as twenty minutes. The method of locomotion did not, of course, differ from that exhibited in inflammation, though excessive change of form, and protrusion of long processes, was not noticed. Frequently a leucocyte flattened against the wall, then a bud appeared external to the wall, and the intra-vascular portion gradually shrank away as this bud increased in size. Often the locomotion was continued after the leucocyte had wholly left the vessel, so that it traveled several times its own diameter from the place of exit. Other corpuscles, too, were prone to pass out at the same point, so that sometimes several would be crowded together within the vascular wall, and an hour later would be in close proximity external to the vessel opposite the same point. Certain red corpuscles of the same shape and size, and without a nucleus, but of unmistakably red color, were frequently seen to migrate in a similar manner, and to such an extent that after thirty-six hours there were many patches in the field which looked almost like hemorrhages. That they were not hemorrhages was inferred, because many of them had been seen to migrate, because they were fixed in the tissue, and not floating in the blood serum, and because they were all small and round, and different from the large, oval, nucleated red corpuscles of the animal experimented upon. This behavior of the small red corpuscles exhibits a close relation with the white, and furnishes another link in the chain of circumstantial evidence that the red corpuscles are transformed white ones. The facts observed would seem to favor the theory that the migration is a simple filtration of colloid substances, from increased blood pressure and diminished blood velocity, rather

than an active movement due to their "glutinosity." How far these facts account for the connective tissue hyperplasia which accompanies varicose veins, the enlargement of the spleen which usually follows portal obstruction, etc., depends upon one's ideas of pathogenesis.

"A Handy Rule for use in Micrometry," by C. M. Vorce, of Cleveland, described very clearly the methods adopted by the author in making miscropical measurements.

Professor Romyn Hitchcock, of New York, in a paper entitled, "A Standard Micrometer," urged the adoption of a standard which should give some uniformity in micrometric work by different observers. Efforts to secure this end have been made, years ago, but they seem to have led to no results. We are now as far from a definite standard as ever, and the question can only be settled by a representative body like this, or by one convened for the special purpose. Not only accuracy but uniformity is essential, for convenience in reading and comparing observations. A fraction of an inch might seem the preferable unit of measurement to us in this country, but it can never become universal. The metric system is the only one that can ever become universal, and we should now adopt it even at some temporary sacrifice of convenience.

Professor Rogers, whose facilities for accurate ruling have been greatly increased during the last few months, proposes to rule six scales, as nearly alike as possible, and donate five of them to the same number of microscopical societies, as standards, the societies having first appointed a committee to examine, compare, and approve the scales. (Near the close of the Congress, resolutions were offered by Professor Hitchcock, and adopted, recommending $\frac{1}{100}$ of a millimetre as our unit of micrometry, requesting microscopical societies to formally adopt this standard, and recommending to the favorable consideration of the societies, Professor W. A. Rogers plan for the acquisition and distribution of standard scales. This action was taken by the Congress without opportunity for discussion, and for the purpose of bringing the matter before the country for concerted action. It is possible that the unit suggested will need reconsideration, as one millimetre might be more convenient and more easily agreed upon than a nameless fraction).—(*To be Continued.*)

EXCHANGES.—Lake Michigan diatoms, mounted or raw material, also diatoms of Northern Illinois, for good slides or material. B. W. Thomas, 132 La Salle street, Chicago, Illinois.

Diatoms: Rhabdonema adriatica, Synedra ulna, splendens and superba, Tabellaria flocculosa, Fragilaria virescens, Isthmia nervosa, diatomaceous earths and other unmounted material, for named diatoms or other good mounted objects. M. A. Booth, Longmeadow, Mass.

Slides of named diatoms, also peristome of Funaria hygro-

metrica, offered in exchange. Jos. McKay, 24 Liberty street, Troy, N. Y.

A variety of interesting objects from the Bahamas, mounted or unmounted, for exchange. C. C. Merriman, Rochester, N. Y.

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SCIENTIFIC NEWS.

— We learn from the parties in the field in the Yellowstone National Park, that the work of Prof. Hayden's United States Geological Survey of the Territories has progressed most favorably despite the unsettled nature of the country, owing to the Indian troubles. The general features of the park have been exhaustively surveyed, an enormous amount of material in the morainal deposits and especially the structure of the Wind River mountains.

Meanwhile the reports of the survey, and particularly the Geological map of Colorado lately issued by this Survey, are winning golden opinions in Europe. A gentleman writes us from Paris as follows: "The Hayden Survey is popular in both England and France. I repeatedly heard expressions of regret that there should be any disposition to hamper or oppose it in any way. Such opposition would be looked on here as springing, without doubt, from unworthy motives." An elaborate notice by Mr. Oldham, the late distinguished director of the Geological Survey of India, appears in the *Geological Magazine*, in which the highest praise is given to the work. That all Americans should take pride in this great work and others of the kind, is made apparent by the favorable notices which have appeared in European journals. In letters lately received at the office of the survey, Prof. Andrew C. Ramsay, the veteran director of the Geological Survey of Great Britain, writes: "I have to-day received a copy of your Colorado Atlas, for which I am exceedingly obliged. I have all the maps, etc., spread out on one of the large drawing tables in the geological survey office, and have had a long look at them. The beauty of the engraving and coloring is most remarkable, and quite astonished me. I know nothing of the kind superior, or even equal to this work, especially when we consider the physical character of the country and the hardships that such a survey must entail. That so much has been done, and done in such a manner, speaks volumes for the energy and skill of you and all your men, and it is a credit to any government to have been the means of producing such a masterly piece of work."

Prof. Archibald Geikie, director of the Geological Survey of Scotland, writes: "Your magnificent Atlas of Colorado has just come. I have had time merely to look over the maps and sections in a cursory way. But I cannot delay to send you a few

lines of the heartiest congratulation on the completion of this most splendid contribution to science, and to the opening up of the resources of your great country. I shall take an early opportunity of going quietly over the maps and of speaking publicly about them. The care and elaboration of the original field-work, and the beauty of the execution of the plates, combine to make this atlas a national work of which any government might justly be proud."

We sincerely hope that Congress will certainly not decrease next year the amount of the annual grant for a survey, which, without disparagement to any other, has been conducted in such a broad as well as prudent spirit as to win golden opinions from those best qualified to judge of the manner of conducting such a survey.

— Prof. Cope has purchased the collections of vertebrate fossils exhibited by the Argentine Confederation at the Exposition of Paris. The collection embraces those of three exhibitors, and is one of the most extensive which has ever left Buenos Ayres. It includes 75 to 100 species, which represent all the more important types of the Pampean formation. There are twelve species of *Glyptodon*, and nineteen nearly complete skeletons of various forms. The most beautiful of these is that of a *Machærodus* similar to the Brazilian species. Prof. Cope retains a series of duplicates, some of them entire skeletons, for sale.

— NOTICE. Having removed from Salem to *Providence, R. I.*, the editorial office of the AMERICAN NATURALIST will be at the latter address, where all exchanges, articles, letters, and specimens designed for the editors may be sent. A. S. PACKARD, JR.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

SAN FRANCISCO MICROSCOPICAL SOCIETY.—The regular meeting was held July 11th. Of the business routine the most interesting part was the announcement of several donations and purchases for the library and cabinet. Rev. Mr. Bleasdale generously completed the suite of Dr. Carpenter's slides, already numbering eleven, by an addition of three more—shell sections of *Unio occidens*, *Anomia ephippium* and *Terebratula ampulla*.

The California State Geological Society presented specimens of "diatomite," from Santa Barbara, a flinty mineral supposed to have been deposited from silica-impregnated waters passing out

of a diatom earth, and Mr. Hanks sent some lichens containing diatoms from a parapet of the Palace at Versailles.

After examining the beautiful slides of foraminifera, mounted by Mr. Merriam and exhibited by President Hyde, the members began their contributions to the topic of the evening, "The microscopical examination of sea water, with reference to its animal and vegetable forms." Dr. Whitney spoke at some length of his physical and chemical investigations upon Pacific ocean water, taken at insetting tide just within the Golden Gate. He spoke of the lime and silica in solution in sea water, and beside attributing to these the origin of the foraminifera shells and diatom frustules, a well-known fact, spoke of the silica in solution as a probable source of sand, since he considered the fine deposit that gradually fell in his jars of sea water as coming from solution, and not as a long suspended silt, the view generally held.

After selecting for the next topic "The Lower Forms of Marine Life," the society listened to a translation, by Secretary Clark, of a short paper on "The Alternate Generation of the Echinodermata," by Prof. Haeckel.

American Association for the Advancement of Science.—The next meeting is to be held in Saratoga on the last Wednesday of August, 1879. The officers elected for that meeting are Prof. G. F. Barker, of Philadelphia, president; Prof. S. P. Langley, of Alleghany, Pa., vice-president of section A; Major J. W. Powell, vice-president of section B; Prof. Ira Remsen, chairman of subsection of chemistry and Prof. E. W. Morley, of Hudson, Ohio, chairman of subsection of microscopy. Among the noteworthy papers in geology and biology were those by C. O. Whitman on the Embryology of Clepsine, Prof. I. E. Todd's on Richthofen's Theory of the Loess in the light of the deposits of the Missouri, A. G. Weatherby's Are the so-called Chætetes of the Cincinnati Group Bryozoans? and his remarks on the Geographical Distribution of the land and freshwater Molluscs of the United States and their local varieties. Major Powell spoke on the rainfall of the arid region of the United States, while Prof. B. G. Wilder made a communication on a remnant of the spiracles in Amia and Lepidosteus, and S. A. Forbes read a paper on the development of Amia, Mr. C. E. Dalton made a communication on the geological history of the Colorado river and plateaus, and Mr. A. Lakes spoke of the discovery of Atlantosaurus and other Dinosaurs in the Rocky mountains of Colorado. The anthropological papers were noticed in our last number.

Boston Society of Natural History, Oct. 2d.—Mr. W. O. Crosby read notes on the physical geography and geology of Trinidad.

APPALACHIAN MOUNTAIN CLUB, Oct. 9th.—Rev. H. G. Spaulding read a paper entitled Something about Moosilauk and the Franconia Range; Prof. J. H. Huntington gave an account of the Megalloway river and its physical and topographical features, while Mt. Ascutney, Vt., was described by Mr. Frederic Gardiner, Jr.

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SCIENTIFIC SERIALS.[1]

PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.—July 6, August 16, No. iv. On the Nyassa and a journey from the north end to Zanzibar (with a map), by H. B. Cotterhill. Travels in Western China and on the eastern borders of Tibet, by W. J. Gill. On the Geographical results of the Mission to Kashgar, under Sir T. Douglas Forsyth, in 1873–4, by H. Trotter. No. v contains the president's (Sir Rutherford Alcock) address. No. vi Geographical sketch of the Nile and Livingstone (Congo) basins, by H. M. Stanley. A lecture on plant-distribution as a field for geographical research, by Thistleton Dyer.

SIEBOLD AND KÖLLIKER'S ZEITSCHRIFT FÜR WISSENSCHAFTLICHE ZOOLOGIE.—September 6. Contributions to a knowledge of the Julidæ, by E. Voges. On the formation of the blastoderm and the germinal layers in insects, by N. Bobretsky. Additions to a knowledge of the genus Brisinga, by H. Ludwig. Aspidura, a genus of mesozoic Ophiuridæ, by H. Pohlig. Fifth article on the structure and development of Sponges. The metamorphosis of *Sycandra raphanus*, by F. E. Schulze.

THE GEOLOGICAL MAGAZINE.—August. On the form of Volcanoes, by J. Milne. On a method of estimating the extent of Geological Areas, by T. M. Hall. September.—Notes on some Arctic Silurian fossils from Beechey island and from Port Dundas, Lancaster sound, by H. Woodward. Cataclysmic theories of Geological Climate, by J. Croll. Land plants in the Irish Silurians, by G. H. Kinahan. Wayside notes in travels over Europe: the great Northern drift, by R. Damon.

THE GEOGRAPHICAL MAGAZINE.—September. The Treaty of Berlin (with a map). Richthofen on Prejevalsky's journey in Central Asia, Abyssinia. A new Survey of the Amazon. Indian irrigation, by H. P. Malet.

PSYCHE.—March and April. The Entomological writings of John L. LeConte, compiled by Samuel Henshaw, edited by George Dimmock. Oviposition in Spiders, by J. H. Emerton.

[1] The articles enumerated under this head are usually selected.